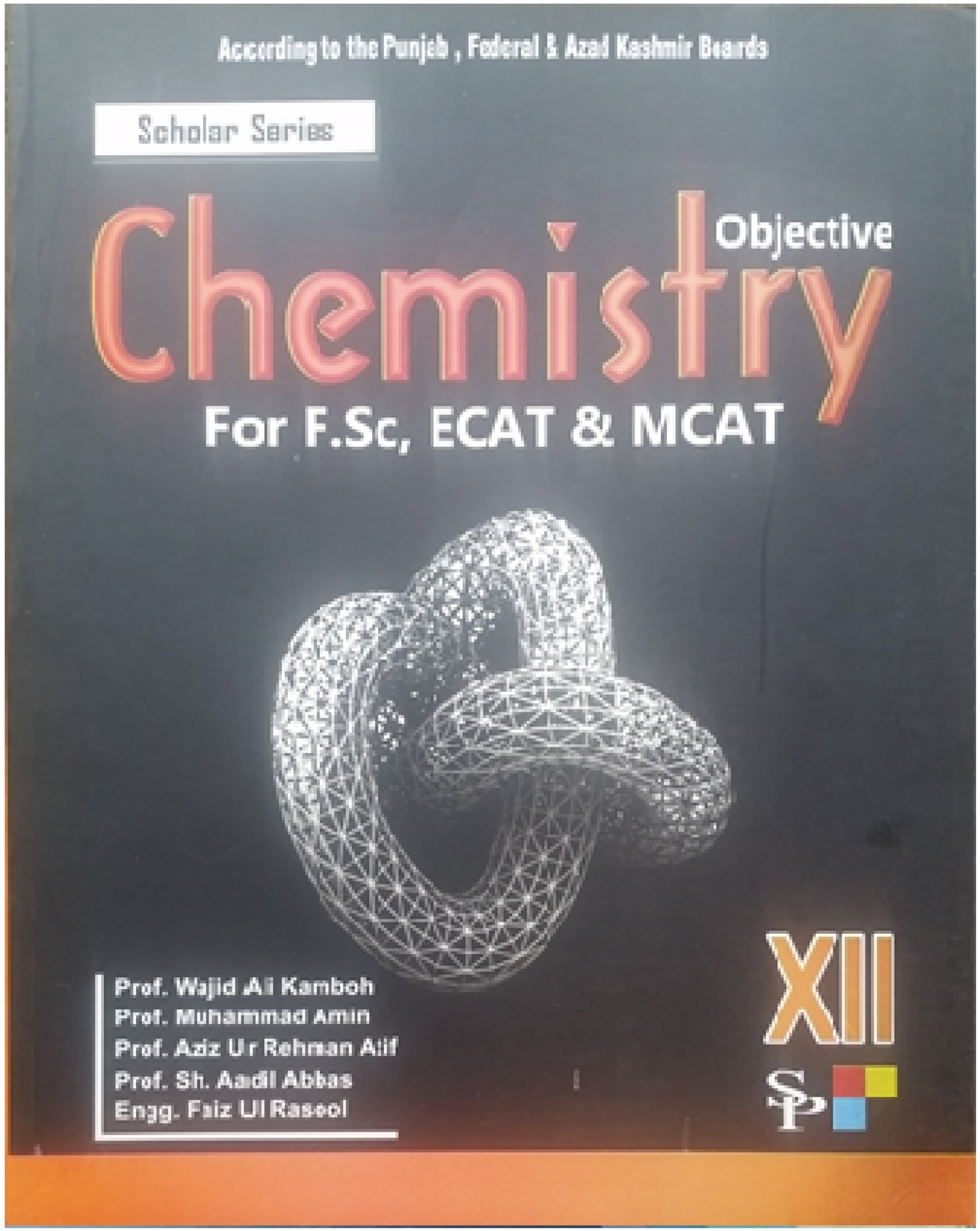


12TH HELPING BOOK PDF

CHAPTER 1

Periodic Classification of Elements and Periodicity

Solved Objective Exercise

Q1. Fill in the blanks.

(i) Mendeleev in his periodic table, arranged the elements according to their atomic _____.
(ii) Vertical columns in modern periodic table are called _____ and horizontal rows are called _____.
(iii) Members of group VIIA are called _____ and alkali metals is the family name of _____ group members.
(iv) Metals form _____ oxides and non-metals form _____ oxides.
(v) Hydrogen can be placed above the groups _____ of the periodic table.
(vi) Shielding effect is actually the _____ due to electrons in between the nucleus and the outermost shell
(vii) Noble gases have the _____ values of ionization energy due to their complete outermost shells.
(viii) When a second electron is added to a uninegative ion, the incoming electron is _____ by the already present negative charge.
(ix) Due to having partly filled d-orbitals _____ metals usually show variable valency.
(x) Melting and boiling points of halogens _____ down the group.

Answer Key.

(i)	Masses	(ii)	Groups, periods
(iii)	Halogens , IA	(iv)	Basic, acidic
(v)	IA, VII A, IV A.	(vi)	Repulsion
(vii)	Highest	(viii)	Repelled
(ix)	Transition	(x)	Increase

Q2. Indicate True or False.

(i) In Mendeleev's periodic table elements Be, Mg, Zn and Cd are placed in the same group.
(ii) The second and third periods contain eighteen elements each.
(iii) Alkaline earth metals are present in Group IIA.
(iv) Metals are present in the top right corner of the periodic table.
(v) Metalloids are present in the lower half of Group IVA, VA and VIA.
(vi) Hydrogen forms uninegative ion like halogens.
(vii) Oxidation state of an elements is related to the number of period it belongs.
(viii) Diamond is a good conductor of electricity.
(ix) Melting points of halogens decrease down the group.
(x) Zinc oxide is an example of amphoteric oxide.

bhatti Academy

Answer Key.

(i)	True	(ii)	False	(iii)	True	(iv)	False	(v)	True
(vi)	True	(vii)	False	(viii)	False	(ix)	False	(x)	True.

3. Multiple Choice Questions. Encircle the correct answer.

Keeping in view the size of atoms, which order is the correct one
(a) Mg > Sr (b) Ba > Mg
(c) Lu > Ce (d) Cl > I

Mark the correct statement
(a) Na^+ is smaller than Na atom (b) Na^+ is larger than Na atom
(c) Cl^- is smaller than Cl atom (d) Cl^- (ion) and Cl (atom) are equal is size

Mark the correct statement
(a) All lanthanides are present in the same group (b) All halogens are present in the same period
(c) All the alkali metals are present in the same group (d) All the noble gases are present in the same period

Which statements is incorrect.
(a) All the metals are good conductor of electricity (b) All the metals are good conductor of heat.
(c) All the metals form positive ions. (d) All the metals form acidic oxides.

Which statement is correct.
(a) Hydrogen resembles in properties with IA, IVA, and VIIA elements.
(b) Hydrogen resembles in properties with IIIA, IVA, and VA elements.
(c) Hydrogen resembles in properties with IIA, IVA, and VIA elements.
(d) Hydrogen resembles in properties with IIA, IIIA, and VIIA elements.

Mark the correct statements.
(a) The ionization energy of calcium is lower than that of barium.
(b) The ionization energy of calcium is lower than that of magnesium.
(c) The ionization energy of calcium is higher than that of beryllium.
(d) The ionization energy of calcium is lower than that of strontium.

Mark the correct statement.
(a) Electron affinity is a measure of energy required to remove the electron.
(b) Electron affinity is a measure of energy released by adding an electron.
(c) Electron affinity is a measure of energy required to excite an electron.
(d) Electron affinity is a measure of energy released by removing an electron.

Mark the correct statement.
(a) Metallic character increases down the group.
(b) Metallic character increases from left to right along a period.
(c) Metallic character remains the same from left to right along a period.
(d) Metallic character remains the same down the group.

Mark the correct statement.
(a) Melting points of halogens decrease down the group.
(b) Melting points of halogens increase down the group.
(c) Melting points of halogens remain the same throughout the group.
(d) Melting points of halogens first increase and then decrease down the group.

Mark the correct statement.
(a) Covalent character of metal halides increases from left to right in a period.
(b) Boiling points of Group IVA hydrides decrease down the group.
(c) Ionic character of hydrides increases from left to right in a period.
(d) The basicity of group IIA oxides decreases on descending the group.

Solved Exercise MCQ's

Q. No	Answer	Reason
(i)	(b) Ba > Mg	Size of atoms increase down the group and decrease across a period.
(ii)	(a) Na^+ is smaller than Na atom	Size of cation is smaller than its parent atom.
(iii)	(c) All the alkali metals are present in the same group	Alkali metals are IA group elements which are Li, Na, K, Rb, Cs, Fr.
(iv)	(d) All the metals form acidic oxides	Metal oxides are not acidic but are basic in nature.
(v)	(a) Hydrogen resembles in properties with IA, IVA and VIIA elements	The resemblance of hydrogen with these elements is because of different properties.
(vi)	(b) The I.E of calcium is lower than that of magnesium.	Ionization energy value decreases down the group due to increase in size.
(vii)	(b) Electron affinity is a measure of energy released by adding an electron.	Electron affinity is energy absorbed or released when addition of electron takes place.
(viii)	(a) Metallic character increases down the group.	Due to increase in atomic size, metals lose electrons easily.
(ix)	(b) Melting point of halogens increase down the group.	As the size of halogens increase, intermolecular forces become stronger so melting point increases
(x)	(a) Covalent character of metal halides increases from left to right in a period.	Across a period, electropositive character of metals decreases so covalent character increases.

Previous Boards MCQ's

1. Mark the correct statement (D.G Khan 2008)
(a) Metals form basic oxides (b) Metals form acidic oxides
(c) Metals are non-conductor of electricity (d) Metals have tendency to accept electron

2. Maximum electron affinity values of N are (D.G Khan 2009)
(a) 1 (b) 2 (c) 3 (d) None

3. The oxides of electropositive elements are (Rwp 2008)
(a) Acidic (b) Basic (c) Amphoteric (d) Neutral

4. Which of the following elements form polymeric halides? (Rwp 2009)
(a) Be (b) Ga (c) Al (d) All of these

5. Zinc oxide is (Rwp 2010)
(a) basic (b) Amphoteric (c) Acidic (d) Neutral

6. The elements of group II-A are called (Fsd 2008)
(a) Alkali metals (b) Alkaline earth metals (c) Coinage metals (d) Metalloids

7. Keeping in view the size of atoms, which order is the correct one? (Fsd 2009)
(a) Mg > Sr (b) Ba > Mg (c) Lu > Ce (d) Cl > I

Chattiacademy

3. In modern periodic table, the elements are arranged in the ascending order of (Grw 2012 Fsd 2010)
(a) Atomic masses (b) Valency (c) Valence electrons (d) Atomic number

9. Memorable contributions in the classification of elements were made by (Sgr 2009)
(a) Al-Razi (b) Dobereiner (c) Newlands (d) All of them

10. The longest period in the periodic table is (Sgr 2010)
(a) 7th (b) 6^{th} (c) 5th (d) 4^{th}

11. Mark the correct statement (Grw 2009)
(a) Na^+ is smaller then Na atom (b) Na^+ is larger than Na atom
(c) Cl is smaller than Cl atom (d) Cl and Cl atom are equal in size

12. f-block elements are also called (Grw 2011)
(a) Non-typical transition elements (b) Outer transition elements
(c) Inner transition elements (d) Normal transition elements

13. The number of elements in fourth period of periodic table is (Grw 2011)
(a) 32 (b) 18 (c) 10 (d) 8

14. Hydrogen can be placed with the elements of group 1V A because both (Lhr 2008)
(a) Act as strong oxidizing agent (b) Act as strong reducing agent
(c) Possess the property of catenation (d) Form neutral oxides

Most of the elements are (Lhr 2010)
(a) Crystalloids (b) Metals (c) Metalloids (d) Non-metals

The decrease in atomic sizes is not much prominent across rows containing elements of (Lhr 2011)
(b) p-Block (c) d-Block (d) f-Block

In the Mendeleev's periodic law the properties of elements are periodic function of their: (Fsd.2012)
(a) Volume (b) Densities (c) Atomic number (d) Atomic masses

Elements of the periodic table are classified into blocks: (Lhr. 2012)
(a) Four (b) Three (c) Five (d) Six

How many elements are present in 5^{th} period of the periodic table (Lhr. 2012)
(a) 32 (b) 8 (c) 18 (d) 28

Entry Test MCQ's

The group number of element in periodic table indicates
(a) Valency with respect to hydrogen (b) The atomicity
(c) The number of electrons in the outermost shell (d) Number of shells

Which one of the following grouping represents a collection of isoelectronic species?
(a) N^{-3}, F^-, Na^+ (b) Ca^{2+}, Al^{3+}, Cl^- (c) Ca^{2+}, Cs^+, Br^{-1} (d) Na^+, Ca^{2+}, Mg^{2+}

If we go from Li to F in the second period, there would be a decrease in
(a) Atomic mass (b) Ionization energy (c) Atomic radii (d) Electronegativity

Ionization energy of nitrogen is more than oxygen because:
(a) Nucleus has more attraction for electrons (b) Nitrogen atom is small
(c) Half-filled p-orbitals are more stable (d) More penetration effect

Which pair of atomic numbers represents s-block elements
(a) 7, 15 (b) 9, 17 (c) 6, 12 (d) 3, 12

Which of the following order is wrong
(a) $NH_3 < PH_3 < AsH_3$ (Acidic) (b) $Al_2O_3 < MgO < Na_2O < KO_2$ (Basic)
(c) Li<Be<C<N (IE_1) (d) $Li^+ < Na^+ < K^+ < Cs^+$ (Ionic radius)

Which of the following processes is endothermic in nature
(a) $O^- + e^- \rightarrow O^{2-}$ (b) $S + e^- \rightarrow S^-$ (c) $Cl + e^- \rightarrow Cl^-$ (d) $F + e^- \rightarrow F^-$

8. Which of the following metals does not form ionic hydride
(a) Ba (b) Mg (c) Ca (d) Sr

9. In the periodic classification of elements, the law of octaves was introduced by
(a) Mendeleev (b) Newlands (c) Dobereiner (d) Lother Meyer

10. In the long form of the periodic table, all the non-metals are placed in
(a) s-block (b) p-block (c) f-block (d) d-block

11. Which of the following species has the highest electron affinity
(a) F^- (b) O^- (c) O (d) Na^+

12. Which of the following elements is most metallic
(a) P (b) Sb (c) As (d) Bi

13. Classification of elements in modern periodic table is based on
(a) Bohr's model (b) Moseley's law
(c) de-Borgile's equations (d) Rutherford model

14. Which of the following oxides is amphoteric in character
(a) CaO (b) SiO_2 (c) CO_2 (d) BeO

15. Hydrides of forth period show greater boiling point than those of third period due to
(a) Hydrogen bonding (b) Low electronegativity
(c) Greater size (d) Dipole-dipole interactions

16. Metallic character of an elements reflects its tendency to
(a) Gain electrons (b) Lose electrons (c) Share electrons (d) Donate electrons

17. Which of the following alkali metals does not exist naturally
(a) Francium (b) Rubidium (c) Lithium (d) Cesium

18. The correct order of stability of hydrides of alkali metals is
(a) LiH > NaH > KH > RbH (b) RbH > KH > NaH > LiH
(c) NaH > KH > RbH > LiH (d) LiH > RbH > KH > NaH

19. The electron affinity of noble gas elements is
(a) Low (b) High (c) Nearly zero (d) Very high

20. Which of the following has largest size
(a) Na (b) He (c) Cl (d) Fr

21. Which one of the following elements has the non-variable oxidation state
(a) Beryllium (b) Bromine (c) Chlorine (d) Nitrogen

22. The elements of I A and IIA group are obtained by the electrolysis of their molten
(a) Chlorides (b) Nitrate (c) Carbonate (d) Oxides

23. Which element is the most electropositive in the periodic table?
(a) Barium (b) Potassium (c) Calcium (d) Cesium

24. Uniqueness of Mendeleev's periodic table is that he
(a) Determined atomic mass of elements (b) Placed Na, K with Ca and Mg
(c) Classified elements into 12 periods (d) Left empty spaces for undiscovered elements

25. Which one of the following determines the position of an element in the Periodic Table?
(a) Chemical reactivity (b) Number of electrons in outer orbital.
(c) First ionization energy (d) Number of protons in the nucleus of its atom

26. Which of the following oxides will produce the strongest acid when treated with water?
(a) Cl_2O_7 (b) SiO_2 (c) P_2O_5 (d) Cl_2O

27. Which statement is incorrect?
(a) Size of the positive ion is smaller than its parent atom
(b) Size of the negative ion is greater than its parent atom
(c) In positive ion number pf protons exceed the number of electron
(d) In negative ion number of proton exceed the number of electrons

28. Which of the following sets contain basic , acidic and amphoteric oxide
(a) Al_2O_3 SiO_2 P_4O_{10} (b) Na_2O MgO Al_2O_3
(c) MgO P_4O_{10} Al_2O_3 (d) Na_2O MgO SO_3

29. Which species represented by the following formula has the largest radius
(a) P^{-3} (b) Cl^{-1} (c) Ar (d) K^+

bhattiAcademy

30. As we move from group I A to groups II A which of the following trend is incorrect
(a) Metallic radius decreases (b) First ionization energy increases
(c) Thermal stability decreases (d) Solubility of compounds increases

31. Which of the species is not isoelectronic
(a) F^{-1} (b) O^{-2} (c) N^{-3} (d) C^{-4}

32. Which of the following elements has greatest value of first ionization energy
(a) N (b) C (c) O (d) B

33. Which halogen has greatest value of electron affinity
(a) F (b) Br (c) Cl (d) I

34. Ionization energy is the index to the metallic character. The element which have
(a) Low ionization energy – metals (b) High ionization energy – non metals
(c) Intermediate – metalloids (d) All of above

35. Which is incorrect statement?
(a) 1st electron affinity value is always negative
(b) Term electronegativity is associated with molecule
(c) Electron affinity is associated with atom
(d) Oxidation number increases down the group

36. Which statement about oxidation number is incorrect?
(a) Oxidation number increases along the period
(b) Oxidation state is the apparent charge on an atom in the compound
(c) Transition elements show more than one oxidation number
(d) Maximum oxidation number is +7

37. Which of the element is the best conductor of electricity?
(a) Zn (b) Cu (c) Fe (d) Ca

38. Hydration energy depends on
(a) Charge on ion (b) Both a & c (c) Size of ion (d) None of above

39. Which element has greater polarizing affect?
(a) Pb^{+2} (b) Both have same polarizing affect
(c) Pb^{+4} (d) Difficult to predict

40. Which of the following oxides of manganese is, more acidic in nature?
(a) MnO (b) MnO_2 (c) Mn_2O_3 (d) Mn_2O_7

41. Which of the following oxide is strongly basic
(a) Na_2O (b) Al_2O_3 (c) MgO (d) Cl_2O_7

42. Hydrogen has which of the following properties?
(a) It act as reducing agent like IA group elements
(b) It shows resemblance with IA, IVA and VII A group
(c) During electrolysis it is collected at cathode like metals
(d) All of above

43. Which is incorrect?
(a) All the metal are good conductors of electricity (b) All the metal form positive ions
(c) All the metals are good conductors of heat (d) All the metals form acidic oxides

44. Which oxide is acidic in nature only?
(a) Na_2O (b) Al_2O_3 (c) ZnO (d) CO_2

Additional MCQs

1. Which of the following oxide is different in nature:
(a) MgO (b) BeO (c) BaO (d) CaO

2. Both hydrogen and alkali metals have:
(a) One electron in valence shell (b) Valence shell is completely filled
(c) Lack one electron in valence shell (d) Valence shell is partially filled

3. Lithium and beryllium in 2nd period resemble in properties with:
(a) Ca & Be (b) Mg & Al (c) O_2, H_2 (d) Na & O_2

4. Non-metallic character is tendency to ..... electron:
(a) Gain (b) Lose (c) a and b (d) None of them

5. The inner transition elements of 7th period are called:
(a) Lanthanides (b) Actinides (c) Rare earth elements (d) Both b & c

6. Which of the following sets of elements are metalloids:
(a) C & Si (b) As & Sb (c) Mg & Na (d) Both a and b

7. From which we can remove electron easily:
(a) Cesium (b) Lithium (c) Aluminium (d) None of these

8. In Diamond, carbon is bonded to other carbon atoms by ..... hybridization.
(a) sp (b) sp^2 (c) sp^3 (d) dsp^3

9. Elements which have giant covalent structures have very:
(a) Low melting points (b) High melting points (c) Moderate M.P (d) None

10. The binding forces between large sized atoms are:
(a) Weak (b) Strong (c) Moderate (d) None of these

11. From left to right in a period, the Hydration Energy of elements:
(a) Decreases (b) Increases (c) Remains same (d) None

12. Halogen atoms in which halides act as a bridge between two atoms of other elements:
(a) Covalent halides (b) Polymeric halides (c) Ionic holides (d) All

13. Iodine is solid due to:
(a) Electronegativity (b) Dipole moment (c) High Polarizability (d) Small size

14. Increasing order of acidity of oxides of Mn is:
(a) $MnO < MnO_2 < Mn_2O_7$ (b) $MnO_2 > Mn_2O_7 > MnO$
(c) $Mn_2O_7 < MnO < MnO_2$ (d) $MnO > MnO_2 > Mn_2O_7$

15. Halides having highest lattice energies are:
(a) Iodides (b) Bromides (c) Chlorides (d) Fluorides

16. Which can form polymeric halide?
(a) Na (b) Be (c) Ba (d) P

17. Which is not an intermediate hydride:
(a) ZnH_2 (b) InH_3 (c) CdH_2 (d) SiH_4

18. Metal halide in their lower oxidation state tends to be:
(a) Ionic (b) Covalent (c) Amphoteric (d) Partly covalent

19. Halogens are best described by which of the following statement?
(a) They are members of group VIII-A in the periodic table.
(b) Their outer electronic shell is complete.
(c) They are oxidizing agents (d) Most of them are colourless

20. The element with Z = 30 is expected to be present in the group:
(a) II-B (b) I-B (c) II-A (d) I-A

21. The element uranium belongs to:
(a) Actinide series (b) Lanthanide Series (c) Transition elements (d) Representative elements

22. The tendency of an atom to attract a shared pair of electrons towards itself in a molecule is?
(a) Electrode potential (b) Ionization energy (c) Electron affinity (d) Electronegativity

23. Atomic mass of Na is average of masses of Li & K. These three elements constitute.
(a) Alkali metals (b) Homologous Series (c) Triad (d) Octave

24. Group of elements which is called coinage elements is:
(a) Cu, Ag, Au (b) Zn, Cd, Hg (c) Se, Y, La (d) Ca, Sr, Ba

PrattiAcademy

25. Electron affinity decreases in a group from top to bottom but electron affinity of Flourine is lesser than Chlorine, the reason is:
(a) Small size of Flourine
(b) More repulsion of the valence electrons of Flourine for the incoming electron.
(c) Both a & b (d) None

26. The statement that every 8th element is similar to first is law of:
(a) Octaves (b) Triads (c) Mendeleev (d) Moseley

27. Which is the most basic of the following oxides?
(a) Al_2O_3 (b) As_2O_3 (c) Na_2O (d) BaO

28. In outer transition elements, the orbitals in process of completion is:
(a) d-orbitals (b) p-orbitals (c) f-orbitals (d) s-orbitals

ANSWERS TO MCQ'S

Previous Boards MCQ's

Q.No	Answer	Reason
1.	(a) Metals form basic oxide	When metal oxides dissolve in H_2O, they give base. e.g. $Na_2O + H_2O \longrightarrow 2NaOH$ (Base)
2.	(d) None	Electron affinity of Nitrogen is -7kJ/mol. Which is very small because of its stable electronic configuration.
3.	(b) Basic	Electropositive elements are metals (Na, Li, K) and metals form basic oxides $4Na + O_2 \longrightarrow 2Na_2O$ (Basic oxide)
4.	(d) All of these	$BeCl_2$, $AlCl_3$, $GaCl_3$ are polymeric halides.
5.	(b) Amphoteric oxide	Reacts as acid with base and reacts as base with acid. $ZnO + H_2SO_4 \longrightarrow ZnSO_4 + H_2O$ Base Acid $ZnO + 2NaOH + H_2O \longrightarrow Na_2[Zn(OH)_4]$ Acid Base
6.	(b) Alkaline earth metals.	(i) They give alkalies in water. (ii) Exist abundantly on earth crust in form of carbonates and silicates.
7.	(b) Ba > Mg	Size increases down the group due to increase in number of shells.
8.	(d) Atomic number	In modern periodic table the base of arrangement is number of protons in nucleus.
9.	(a) Al-Razi	He classified elements on basis of physical and chemical properties of element and compounds.
10.	(b) 6th	It has 32 elements and is a longest period.
11.	(a) Na^+ is smaller than Na atom.	$Na \longrightarrow Na^+ + 1e^-$ 157Pm 95Pm
12.	(c) Inner transition elements.	In these elements, three outermost shells are not completely filled. The last electron in them enters in the (n – 2) subshells.
13.	(b) 18	Fourth period is called long period.
14.	(b) Act as strong reducing agent.	$H_2 + CuO \longrightarrow Cu + H_2O$ $C + SnO_2 \longrightarrow CO_2 + Sn$
15.	(b) Metals	s & d - block elements.
16.	(c) d-block	Due to diffused d sub - shell.

17.	(d) Atomic masses	Mendeleev arranged the elements in increasing order of their atomic masses.
18.	(a) Four	(a) s-block (b) p-block (c) d-block (d) f-block
19.	(c) 18	5th period is also called long period.

Entry Test MCQ's

1.	(c) Number of electrons in outermost shell.	All alkali metals belong to IA group and halogens belongs to VII group and have one and seven electrons in their valence shell.
2.	(a) N^{3-}, F^-, Na^+	Iso electronic species are those consists of same number of electrons N^{3-}, F^-, and Na^+ contain 10 electrons each.
3.	(c) Atomic radii	Due to increase in nuclear charge and addition of electrons in same shell
4.	(c) Half filled p-orbital are more stable.	$_7N = 1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$ It is difficult to add electrons.
5.	(d) 3,12	$_3Li = 1s^2 2s^1$, $_{12}Mg = 1s^2 2s^2 2p^6 3s^2$ (filling process completed by s-orbital)
6.	(a) $NH_3 < PH_3 < AsH_3$ (Acidic)	Basic character increases down the group (NH_3 is more acidic (less basic).
7.	(a) $O^- + e^- \longrightarrow O^{-2}$	Second electron affinity is always positive, so it is endothermic process.
8.	(b) Mg	Mg form intermediate hydride (MgH_2)
9.	(b) Newlands	In 1864, an English chemist John Newlands classify the elements by giving law of octaves.
10.	(b) p-block	In all nonmetals, p-block is in filling process.
11.	(b) O^-	F^- and Na^+ have low electron affinity but O^- has high electron affinity as compared to O. $O + e^- \longrightarrow O^-$ E.A = –141kJ mol^{-1} $O^- + e^- \longrightarrow O^{-2}$ E.A = +780kJ mol^{-1}
12.	(d) Bi	Metallic character increases down the group.
13.	(b) Moseley's Law	Moseley introduced atomic number in his law in 1911.
14.	(d) BeO	BeO is amphoteric oxide as $BeO + H_2SO_4 \longrightarrow BeSO_4 + H_2O$ $BeO + NaOH + H_2O \longrightarrow Na_2[Be(OH)_4]$
15.	(c) Greater size	Greater size of molecule ∝ Greater polarizability.
16.	(b) Loss electron	Elements which lose electrons easily are good metals.
17.	(a) Francium	It is radioactive element.
18.	(b) RbH > KH > NaH > LiH	With the increase in size of cation stability decreases.
19.	(c) Nearly zero	Noble gases have complete outermost shell and are unable to accept the electrons.
20.	(d) Fr	Fr has maximum shells among these four elements.
21.	(a) Beryllium	It has +2 oxidation state.
22.	(a) Chlorides	Sodium metal is prepared by electrolysis of molten NaCl.
23.	(d) Cesium	Cesium has greatest size and lose electron easily so it is more electropositive.
24.	(d) Left empty spaces for	Mendeleev's left empty spaces for undiscovered elements and predicted their

Punjab Academy

	undiscovered elements.	properties also. It was very helpful in discovering new elements.
25.	(d) Number of protons in the nucleus of its atom	According to Modern periodic table elements are arranged on the basis of increasing order of atomic number.
26.	(a) Cl_2O_7	$Cl_2O_7 + H_2O \longrightarrow 2HClO_4$ (Which is stronger acid). Perchloric acid
27.	(d) In negative ion number of proton exceed the number of electron.	In negative ion number of electrons are greater than number of proton Cl^- has 18e and 17 proton.
28.	(c) MgO, P_2O_5, Al_2O_3	MgO ⟶ Basic oxide P_2O_5 ⟶ Acidic oxide Al_2O_3 ⟶ Amphoteric oxide
29.	(a) P^{-3}	All elements or ions have same electrons in valence shell but P^{-3} has least nuclear force among them.
30.	(c) Thermal stability decreases	Metallic bond strength increases from IA to IIA thermal stability increases.
31.	(d) C^{-2}	It has 9 electrons while (F^-, O^{-2}, N^{-3}) has 10 electrons.
32.	(a) N	Nitrogen has partially filled orbital and extra stable so it is difficult to remove electron.
33.	(c) Cl	Halogens | Electron affinity kJ/mol Fluorine | 322 Chlorine | 349 Bromine | 325 Iodine | 295
34.	(d) All of above	Metals lose electron easily. It is difficult to remove electron from non-metals. Metalloids are intermediate between metals and non-metals.
35.	(d) Oxidation number increases down the group.	Oxidation state remains constant down the group.
36.	(d) Maximum oxidation state is +7	Ruthenium (Rh) and osmium (Os) show maximum oxidation state (+8).
37.	(c) Cu	Coinage metals (Cu, Ag, Au) have an extraordinary high value of electrical conductivity
38.	(b) both a & c	Hydration energy $\propto$ charge density $\propto \frac{\text{charge}}{\text{size}}$
39.	(c) Pb^{+4}	Pb^{+4}. As charge density $\propto \frac{\text{charge}}{\text{size}}$ $\frac{\text{charge}}{\text{size}} \propto$ Polarizing power $\propto$ Polarization
40.	(d) Mn_2O_7	As the oxidation state increases acidic nature increases.
41.	Na_2O	$Na_2O + H_2O \longrightarrow 2NaOH$ Strong base
42.	(d) All of aboye	Hydrogen is a unique element whose properties do not match exactly with any of the groups in the periodic table.
43.	(d) All the metals form acidic Oxide	Metals really form Basic Oxide. $4Na + O_2 \longrightarrow Na_2O$ Basic oxide
44.	(d) CO_2	$CO_2 + H_2O \longrightarrow H_2CO_3$ (Carbonic acid)

Additional MCQ's

1.	(b) BeO	BeO is amphoteric in nature. $BeO + H_2SO_4 \longrightarrow BeSO_4 + H_2O$ $BeO + 2NaOH + H_2O \longrightarrow Na_2[Be(OH)_4]$
2.	(a) One electron in valence shell	Valence shell electronic configuration of $_1H = 1s^1$ & $_{11}Na = 1s^2 2s^2 2p^6 3s^1$
3.	(b) Mg & Al	Li & Be resemble in properties with Mg & Al respectively due to diagonal relationship.
4.	(b) Lose	Greater the tendency of metals to lose electron, greater is the metallic character.
5.	(d) Both b & c	Actinides are elements of 7^{th} period which are rare earth elements.
6.	(b) As & Sb	Metallic character increases down the group. N & P are non - metals. As & Sb are metalloid & Bi is metal.
7.	(a) Cesium	It is easy to remove an electron from cesium due to its large size.
8.	(e) sp^3	Structure of diamond is tetrahedral in which each atom is sp^3 hybridized.
9.	(b) High melting point	Due to large size, it is difficult to break intermolecular forces.
10.	(b) Strong	Greater the size of molecule $\propto$ Polarizability $\propto$ Strong LDF
11.	(b) Increases	From left to right, charge on positive ions increases & size decreases so I. E increases.
12.	(b) Polymeric halides	The structure of $AlCl_3$ is polymeric. In which halogen atom i.e. Cl acts as a bridge, between two metal (Al) atoms.
13.	(c) High Polarizability	Due to high polarizability, Intermolecular forces in I_2 are strong so it is solid.
14.	(a) $MnO < MnO_2 < Mn_2O_7$	Greater the oxidation state, greater will be the acidic strength.
15.	(d) Fluorides	Due to small size of F^- ion, ionic fluorides are more stable. So they have high lattice energies.
16.	(b) Be	Na & Ba form ionic halides while P forms covalent halides.
17.	(d) SiHu	Only MgH_2, ZnH_2, CdH_2, TnH_3 & TlH_3 are intermediate hydrides. SiH_4 is covalent hydride.
18.	(a) Ionic	$Pb^{+2}Cl_2$ is ionic where $Pb^{+4}Cl_4$ is covalent.
19.	(c) They are oxidizing agents	Halogens have greater tendency to gain electron so they oxidize others by removing electrons from other substances.
20.	(a) II – B	Zn has $z = 30$ which belongs to II – B.
21.	(a) Actinide series	U ⟶ Belong to 7^{th} period U ⟶ An element of 5f-series U ⟶ A member of actinide series
22.	(d) Electronegativity	Fluorine has greater electronegativity value which is 4 : 1.
23.	(c) Triad	The law of triads was given by a German chemist Dobereiner.
24.	(a) Cu, Ag, Au	These metals are used to make coins and are known as coinage metals.
25.	(c) Both a & b	F^- = –322 kJ/mol & Cl = –349 kJ/mol
26.	(a) Octaves	In 1864, an English chemist John Newlands classify the elements by giving law of octaves.
27.	(c) Na_2O	$Na_2 + H_2O \longrightarrow 2NaOH$ (Strong Base)
28.	(a) d –orbitals	d – block elements are called outer transition elements while f – block elements are called inner transition elements.

Bhatti Academy

Short Answers Questions

1. Define Dobereiner's law of triads. Also give two examples.

Ans. Dobereiner's law of Triads

In 1829, a German chemist, Dobereiner arranged then known elements in groups called triads, as each contained three elements with similar properties. According to his law of Triads:

"The atomic mass of middle element is the average of atomic masses of the other two elements of triads."

Examples:

Triad	Li	Na	K	Atomic mass of Na $= \frac{7+39}{2} = 23$
Atomic mass	7	23	39	
Triad	Ca	Sr	Ba	Atomic mass of Sr $= \frac{40+137}{2} = 88.5$
Atomic mass	40	88	137	

2. Define Mendeleev's and modern periodic law. (Lhr 12)

Ans. Mendeleev's Periodic Law

"If the elements are arranged in ascending order of their atomic masses, their chemical properties repeat in a periodic manner."

Modern Periodic Law

" If the elements are arranged in ascending order of their atomic numbers, their chemical properties repeat in a periodic manner."

3. Write two defects of Mendeleev's periodic table. (Lhr 12)

Ans. Defects of Mendeleev's Periodic Table

In spite of its useful role in the study of chemistry, Mendeleev's table possessed many drawbacks. Two of these drawbacks are

- **Position of Isotopes**
  On the basis of atomic weight, various isotopes of the same elements should be assigned different places in the periodic table. Mendeleev could not provide separate places for isotopes.
- **Anomalous Pairs**
  In Mendeleev's table based on atomic weight, the position of certain pairs e.g., Argon (at . wt = 39. ,94) and potassium (at. wt = 35 39.1) cobalt (at. wt. = 58.93) an nickel (at. wt = 58.71), Tellurium (at.wt. = 127.60) and iodine (at. wt = 126.90) would be reversed. In other words, certain pairs of elements are misfit in the periodic table, if atomic weight is the basis of classification.

4. Give four improvements made in Mendeleev's periodic table. (Lhr 12)

Ans. Improvements in Mendeleev's periodic table

i) **Atomic Number**
The elements were arranged in ascending order of their atomic numbers instead of their atomic masses.

ii) **Extra Group**
For the arrangement of Noble gasses, one extra group (VIII-A) was added at the extreme right of the periodic table. These gases had not been discovered in Mendeleev's time.

iii) **Sub-group**
In Mendeleev's periodic table, the elements like Be, Mg, Ca, Sr, Ba and Zn, Cd, Hg were placed in a single vertical group although they possess different properties. This confusion was removed by dividing the elements in two types of vertical group A and B.

iv) **Position of Isotopes**
If the elements are arranged in the order of their increasing atomic masses, it is not possible to accommodate a large number of isotopes. This problem was solved by arranging elements in ascending order of their atomic numbers.

5. Write name and symbol of an element from s-block that has zero oxidation state. Also write its electronic configuration. (Lhr 11)

Ans. Element from s-block having zero oxidation state

The name of the element which belongs to s-block is helium. Its symbol is He. Its electronic configuration is $_2He = 1s^2$

6. Zn, Cd, Hg were placed with Alkaline earth metals in Mendeleev's table. How this confusion is removed in modern periodic table?

Ans. Position of Zn, Cd, Hg in Mendeleev's Periodic table

In Mendeleev's periodic table Zn, Cd, Hg and alkaline earth metals (Be, Mg, Ca, Sr, Ba) were placed in a single group although they possess different properties.

This confusion was removed by dividing the elements in two types of vertical groups A and B.

7. Define Group and period. How many elements are there in period number 1? (Fsd 09)

Ans. Group

"Elements with similar properties are placed in vertical column called group"

- There are eight (8) groups in modern periodic table, which are usually numbered by Roman numerals I to VIII.

Period

"The horizontal row of elements in periodic table is called period."

- There are 7 periods in the modern periodic table numbered by Arabic numerals 1 to 7.

Period number 1

There are two elements in period number 1 i.e., hydrogen (H) and helium (He)

8. Describe 6th period of modern periodic table. (Grw 11)

Ans. 6th Period of Periodic table

6th periodic contains thirty two (32) elements and is called **very long period**. In this period there are eight representative elements, **ten** transition elements and a new set of fourteen elements called **Lanthanides** as they start after $_{57}$**La**.

Lanthanides have remarkably similar properties and are usually shown separately at the bottom of the periodic table.

9. Explain why d and f-block elements are called transition elements? (Fsd 08)

Ans. d and f-block elements

The d and f-block elements are called transition elements because they are located between the s and p-block elements and their properties are in transition between the metallic elements of the s-block and non-metallic elements of the p-block.

10. Why anion is always bigger than its parental atom? (Grw 10, Lhr 08, Rwp 07)

Ans. Anion is bigger than its parental atom

When a neutral atom gains one or more electrons, it becomes a negative ion (anion). The size of the ion is increased because of two reasons given below

i) Incoming electron is repelled by the valence electron. So, in order to add this incoming electrons, the expansion of the shell takes place which ultimately reduces the repulsion.

ii) Imbalance in electron-proton ratio occurs. As a result, the ionic radius of negative ion become greater than the size of its parent atom.

Bhatti Academy

Example: $F_{(2,7)} + 1e^- \longrightarrow F^-_{(2,8)}$
72 pm 136 pm

The radius of F-atom is 72 pm while that of fluoride ion (F^-) is 136 pm.

11. Why the atomic radius decreases from left to the right within a period and increases from top to bottom with a group? (Grw 11, Rwp 10, Lhr 09)

Ans. Trend of Atomic Radius

a) **Across the period:** Atomic radius decreases left to right in a period. This is because of:
- Increase in atomic number.
- Increase in the positive charge in the nucleus. As positive nuclear charge increases, the negatively charged electrons in the shells are pulled closer to the nucleus.

b) **Down the Group:** Atomic radius increases down the group. This is because of:
- Increase in number of shells.
- Increase in shielding effect down the group due to increase in intervening electrons. Thus atomic radius increase.

12. What is meant by lanthanide contraction? (D.G Khan 09)

Ans. Lanthanide Contraction

Lanthanide contraction is the steady decrease in the size of the atoms and ions of the rare earth elements with increasing atomic number from lanthanum (**atomic number 57**) through lutetium (**atomic number 71**). For each consecutive atom, the nuclear charge is more positive by one unit, accompanied by the corresponding increase the number of electrons present in the **4f orbitals** surrounding the nucleus.

The 4f electrons very imperfectly shield each other from the increased positive charge of the nucleus, so that the effective nuclear charge attracting each electron steadily increases through the lanthanide elements.

13. How lanthanide contraction controls atomic size across the periods? (Fsd sup 10)

Ans. Decrease in atomic size due to lanthanide contraction

The Lanthanide contraction is the result of a poor shielding effect of the 4f electrons. The shielding effect is described as "the phenomenon by which inner-shell electrons shield the outer-shell electrons so they are not effected by nuclear charge." So when the shielding is not as good, this would mean that the positively charged nucleus has greater, attraction to the electrons, thus decreasing the atomic radius as the atomic number increases. The s-orbital has the greatest shielding while f-orbital has the least.

14. Why the ionic radius of a positive ion is smaller than its neutral atom? (Grw 09)

Ans. Ionic Radius of Cation

A positive ion or cation is formed by the loss of one or more electrons from a neutral atom. The size of cation is always smaller than its parent atom. This is because of

i) Removal of one or more electrons from neutral atom usually results in the loss of outermost shell.

ii) Removal of electrons causes an imbalance in electron – proton ratio. Due to greater attraction of nuclear charge, the remaining electrons of ions are drawn closer to the nucleus.

Example $Na \longrightarrow Na^+ + ie^-$
157 pm 95 pm

15. Explain why electron affinity of dinegative ion is endothermic? (Lhr 08, Rwp 09)

Ans. Electron affinity of dinegative ion

Usually the electronegative elements release energy when first electron is added into them. But when a second electron is added in a uni-negative ion, the incoming electron is repelled by the already present **negative ion.** In order to overcome this **repulsion**, energy is absorbed during the process. Thus the formation of a dinegative ion is an **endothermic process** and its electron affinity is shown with positive.

$O + e^- \longrightarrow O^-$ $E.A_1 = -141$ kJ/mol

$O^- + e^- \longrightarrow O^{-2}$ $E.A_2 = +780$ kJ/mol

16. Define ionization energy. Give its trend across a period and a group. (Lhr 12, Grw 08, Rwp 08, D.G Khan 10)

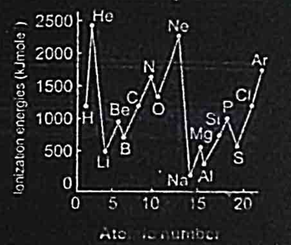
Ans. Ionization Energy

The minimum amount of energy which is required to remove an electron from the outermost shell of its isolated gaseous atom is called ionization energy."

Example

$Na \longrightarrow Na^+ + 1e^-$ I. E = 496 kJ/mol

Periodic Trend



a) **Across the period:-**
The value of ionization energy increases from left to right in a period.
- Due to decrease in atomic radius nuclear charge increases, more strongly electrons are bound to the nucleus and hence higher the ionization energy of the atom.
- **Nuclear Charge** increases effectively makes removed of electron difficult and hence value of ionization energy increases.
- **Shielding Effect** almost remains constant.

The figure also reveals that inert gasses have the highest ionization energies values, because due to complete outermost shell in them, the removal of electron is extremely difficult.

b) **Down the Group**
The value of ionization energy decreases from top to bottom in a group.
- Addition of an extra shell successively in each period hence more number of electrons shields the nucleus.
- The nuclear charge increases by the size of the atom and number of electrons causing the shielding effect also increases therefore ionization energy decreases from top to bottom.

17. Give variations of electron affinity down a group and across a period. (Grw 08, Rwp 08)

Ans. Periodic Trend of Electron Affinity

Across the period
Across the period electron affinity increases due to
- Increase in atomic number.
- Decrease in atomic radius.
- Shielding effect almost remains same.

Down the Group
When we move from top to bottom in the group, electron affinity decreases due to:
- Increase in atomic radius.
- Increase in shielding effect.

18. Why metallic character increases from top to bottom in a group of metals? (D.G Khan 08)

Ans. Trend of Metallic Character in a Group

"The tendency of an element to lose electron and form a positive ion is called metallic character."

Down the group, as it becomes easier to remove the electron from an atom bigger in size, therefore, metallic character increases from top to bottom in a given group of elements.

19. Why melting and boiling points of elements belonging to groups VA-VIIA are lower? (Lhr 11)

Ans. Melting and boiling points of group V A to VII A

- The elements of group VA to VIIA exist as small discrete covalent molecules, rather than as three dimensional lattices. For instance, nitrogen, oxygen and fluorine exists as individual molecules which have very weak intermolecular forces and hence they have extremely low melting and boiling points.
- The melting and boiling point of a substance depends upon the intermolecular forces present in it.

Bhatti Academy

20. Why oxidation state of noble gases is usually zero? (Sgr 10) (Grw 08) (Fsd 12) (Rwp 09)

Ans. Oxidation State of noble gases:

"Oxidation state of an element is directly or indirectly related to the number of valence electrons or the no. of vacancies available in its valence shell."

In case of noble gases, their outermost shells are completely filled with electrons and no vacancy is available in their outermost shells. Those, these gases usually show zero oxidation state with reference to which they are often called zero group elements.

21. The oxidation states vary in a period but remain almost constant in a group. Give reason. (Grw 11, Fsd 08)

Ans. Trend in Oxidation state

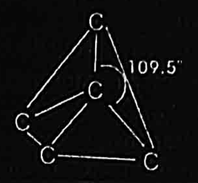
Oxidation state of an element is directly or indirectly related to the number of its valence shell or the number of vacancies available in its valence shell.

When we move from left to right a period, the number of valence electrons goes on increasing so the oxidation state of elements also changes accordingly. But within a group all elements have same number of valence electrons in their outermost shells. As a result, the oxidation state remains almost constant in a group.

22. Why diamond is a non-conductor while graphite is fairly a good conductor? (Fsd 10)

Ans. Diamond is a non-Conductor

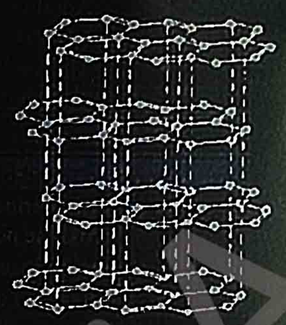
In diamond tetrahedral structure is present. Each carbocation is sp^3 hybridized and forms four sigma bonds with four other carbon atoms. Sigma bond is a very stable bond an σ – electrons are highly localized. They can't move from one place to another. As no free electrons are available in diamond so it is a non – conductor of heat and electricity.



Graphite as a conductor

In graphite, each carbon is sp^2 hybridized and forms three σ – bonds with other C – atoms. The un-hybridized p-orbitals bound to form a π – electron cloud between two layers of graphite.

These π – electrons are highly delocalized so they can conduct electricity parallel to the layers. In graphite hexagonal structure is present. That's why graphite is a good conductor parallel to layers but not perpendicular to the layers.



23. Define Hydration energy of ions. Why negative ions have lesser hydration energy than that of positive ions? (Mtn 12)) (Fsd 09)

Ans. Hydration Energy

"The heat absorbed or evolved when one mole of gaseous ions dissolve in water to give an infinitely dilute solution is called hydration energy."

e.g.,

$$H^+_{(g)} + H_2O_{(l)} \longrightarrow H_3O^+_{(aq)} \qquad \Delta H_h = -1075\ kJ/mol$$

Hydration energy of negative ions is lesser than that of positive ions

Hydration energy greatly depends upon charge density (charge to size ratio) of the ions. Greater the charge density higher will be the hydration energy.

The size of negative ions is always greater than that of positive ions. Due to which charge to size ratio or charge density of negative ions is less than positive ions so, hydration energy of negative ions is also lesser than that of positive ions.

24. Hydration energies of the ions are in the following order: $Al^{+3} > Mg^{+2} > Na^+$.

Ans. Hydration energy depends upon charge to size ratio (charge density) of the ions. Ions having high charge density have high hydration energies.

On moving from left to right in a periods the charge of iso-electronic +ive ions increases but their size decrease as Na^+, Mg^{+2} and Al^{+3} belong to the same period so same trend is followed in these ions. Al- being smaller in size have high charge density and consequently possess highest hydration energy. As the result of this the order is:

Ions	Hydration Energy
Na^+	–390 kJmol^{-1}
Mg^{+2}	–1891 kJmol^{-1}
Al^{+3}	–4613 kJmol^{-1}

25. What are covalent halides? Give two examples. (Fsd 10)

Ans. Covalent Halides

Least electropositive elements of IVA, VA, VIA groups having less electronegativity difference with halogen atom, form covalent halides.

Examples: CCl_4, NF_3, PCl_3, S_2Cl_2 etc.

Properties

- The intermolecular forces in covalent halides are weak van der Waal's forces.
- They often exist in gases, liquids or low melting point solids.
- They have low melting & boiling points.
- Non-conductor of electricity.

26. $PbCl_2$ is mainly ionic but $PbCl_4$ is fairly covalent. Why? (Sgr 09)

Ans. $PbCl_2$ is ionic and $PbCl_4$ is covalent

In case of an element forming more than one halides, the metal halide in its lower oxidation state tends to be ionic, while that in the higher oxidation state is covalent.

This is because the polarizing power of higher oxidation state metal ion e.g., Pb^{+4} is very high than that of Pb^{+2}.

Thus **Charge density ∝ Polarizing power ∝ Covalent character**

So, $PbCl_2$ is mainly ionic and $PbCl_4$ is fairly covalent.

27. What are ionic hydrides? Write their two properties. (D.G. Khan 10)

Ans. Ionic Hydrides

"The elements of group IA an the heavier members of group IIA form ionic hydrides. They have ionic bond."

Examples: NaH, CaH_2, KH etc.

Properties

- Ionic hydrides are crystalline solid compounds, with high melting and boiling points.
- These hydrides are conductor of electricity in molten state and aqueous solution.

28. Why alkali metals give ionic hydrides? (D.G. Khan 08)

Ans. Alkali metals give ionic hydrides

Alkali metals are more electropositive than hydrogen. They have a tendeney to lose electrons and form a unipositive ion. This electron is accepted by hydrogen to form a hydride ion (H^-). These positive and negative ions then combine to form an ionic bond. That's why alkali metals give ionic hydrides.

29. What is the trend of boiling points of hydrides of VIA group? (Lhr 10)

Ans. The boiling points of covalent hydrides like that of group VIA generally increase on descending a group except H_2O, which, due to hydrogen bonding has higher boiling point than might be expected.

Hydrides	Boiling Points
H_2O	100 °C
H_2S	-59.6 °C
H_2Se	-41.3 °C
H_2Te	-1.8 °C

30. ZnO is an amphoteric oxide. Justify. (D.G.Khan 09) (Sgr 10) (Rwp 10)

Ans. ZnO – as an amphoteric oxide

"Oxide which behaves as base when reacts with strong acids and behaves as acid when react with strong bases is called an amphoteric oxide."

Bhatti Academy

- The reaction of ZnO with sulphuric acid is

$$\underset{\text{Base}}{ZnO} + \underset{\text{Acid}}{H_2SO_4} \longrightarrow \underset{\text{Salt}}{ZnSO_4} + H_2O$$

- ZnO reacts with base (NaOH) as following

$$\underset{\text{Acid}}{ZnO} + \underset{\text{Base}}{2NaOH} + H_2O \longrightarrow \underset{\text{Salt}}{Na_2[Zn(OH)_4]}$$

31. Why Na_2O is basic and P_2O_5 is acidic in character inspite of the fact that both Na and P are present in the same period? (Grw 12)

Ans. Na_2O = Basic while P_2O_5 = acidic

Although Na and P belong to the same period but their metallic character differs a lot. On moving from left to right in a period, the nuclear charge increases due to which the size decreases. This increased nuclear charge is responsible for decreasing the metallic character. As a result Na being metal forms basic oxide as it yields base in water.

$$Na_2O + H_2O \longrightarrow 2NaOH \text{ (Base)}$$

While P being a non-metal gives acidic oxide as it yields acid in water.

$$P_2O_5 + 3H_2O \longrightarrow 2H_3PO_3 \text{ (Acid)}$$

32. Why hydrogen can be placed at the top of group I-A elements in the periodic table? (Lhr 09) (Grw 12)

Ans. Similarities between Hydrogen and Group IA elements

- Hydrogen and alkali metals have one electron in their valence "s" subshell.
- Valence shell electronic configuration of hydrogen and alkali metal is same i.e., ns^1
- Both hydrogen and alkali metals have a strong tendency to combine with electronegative elements such as halogens.
- Both hydrogen and halogens by losing their valence electron, from uni-positive ion.

$$H \longrightarrow H^+ + 1e^-$$
$$M \longrightarrow M^+ + 1e^-$$

- Both form ionic compounds which dissociate in water.
- Both hydrogen and alkali metals are good reducing agents.

3. Give two similarities & two differences of hydrogen with IV group of periodic table. (Grw 09) (Lhr 10)

is. Similarities between Hydrogen and IVA group elements

- Hydrogen has half-filled outermost shell like that of elements of IV A group.
- Like carbon, hydrogen also shows remarkable reducing property.

$$CuO + H_2 \longrightarrow Cu + H_2O$$
$$SnO_2 + C \longrightarrow Sn + CO_2$$

Similarities

• Hydrogen belongs to s-block	• The elements of IV A group belong to p-block.
• Hydrogen is a gas at room temperature.	• IVA group elements are solid at room temperature.

****

CHAPTER 2

s-BLOCK ELEMENTS

Solved Objective Exercise

Q1. Fill in the blanks.

(i) Alkali metals are _____ reactive than alkaline – earth metals.
(ii) Alkali metals decompose water vigorously producing _____ and hydrogen.
(iii) When heated in a current of dry hydrogen, alkaline earth metals form white crystalline _____ of the type MH_2.
(iv) The beryllium hydroxide, like the hydroxide of aluminium is amphoteric, while the hydroxides of the other members of the group IIA are _____.
(v) The elements of the group IA are termed as alkali metals, because their _____ are alkaline.
(vi) Spodumene is an ore of _____ metal.
(vii) Alkali metal nitrates on heating give the corresponding _____ and oxygen.
(viii) $Na_2CO_3.H_2O$ is the chemical formula of a mineral of sodium which is known as _____.
(ix) Metallic bicarbonates are decomposed on heating into their carbonates, along with _____ and _____.
(x) Metal nitrates other than the alkali metals on heating decompose into the corresponding metal _____ along with the evolution of nitrogen peroxide and oxygen.

Answer Key.

(i)	More	(ii)	Metal hydroxide	(iii)	Metal hydrides
(iv)	Basic	(v)	Oxides / solutions	(vi)	Lithium
(vii)	Nitrite	(viii)	Natron	(ix)	CO_2 & H_2O
(x)	Oxide				

Q2. Indicate True or False.

(i) Group IA elements are called alkali metals because their chlorides are alkaline in nature.
(ii) Alkali metals are very good conductor of electricity.
(iii) The hydroxides of alkali metals and alkaline – earth metals are soluble in water.
(iv) Plaster of Paris is hemihydrate.
(v) Alkali metals have low melting and boiling points as compared to those of alkaline – earth metals.
(vi) Lithium carbonate is decomposed to its oxide, but the carbonates of the other alkali metals are stable towards heat.
(vii) All alkali metal sulphates are insoluble in water
(viii) Lithium combines with nitrogen to from lithium nitride but other alkali metals do not react with nitrogen.
(ix) Trona is mineral of lithium.
(x) Alkaline – earth metals are stronger reducing agents than alkali metals.

Answer Key.

(i)	False	(ii)	True	(iii)	False	(iv)	False	(v)	True
(vi)	True	(vii)	False	(viii)	True	(ix)	False	(x)	False

bhattiAcademy

Q3. Multiple Choice Questions. Encircle the correct answer.

(i) Which one of the following does not belong to alkaline-earth metals?
(a) Pb (b) Ra (c) Ba (d) Rn

(ii) The oxides of beryllium are?
(a) Acidic (b) Basic (c) Amphoteric (d) None of these

(iii) Which ion will have maximum value of heat of hydration?
(a) Na^+ (b) Cs^+ (c) Ba^{+2} (d) Mg^{+2}

(iv) Which one of the following is not an alkali metal?
(a) Francium (b) Caesium (c) Rubidium (d) Radium

(v) Which of the following sulphates is not soluble in water?
(a) Sodium Sulphate (b) Potassium sulphate (c) Zinc sulphate (d) Barium sulphate

(vi) The element caesium bears resemblance with
(a) Ca (b) Cr (c) Both of these (d) None of these metals

(vii) Chile saltpetre has the chemical formula?
(a) $NaNO_3$ (b) KNO_3 (c) $Na_2B_4O_7$ (d) $Na_2CO_3.H_2O$

(viii) The mineral $CaSO_4.2H_2O$ has the general name:
(a) Gypsum (b) Dolomite (c) Calcite (d) Epsom salt

(ix) Down's cell is used to prepare?
(a) Sodium carbonate (b) Sodium bicarbonate (c) Sodium metal (d) Sodium hydroxide

(x) Which element is deposited at the cathode during the electrolysis of brine in diaphragm cell?
(a) H_2 (b) Na (c) Cl_2 (d) O_2

Solved Exercise MCQ's

Q. No	Answer	Reason
(i)	(d) Rn	Rn is a noble gas.
(ii)	(c) Amphoteric	BeO is amphoteric because it behaves as an acid with bases and as a base with acids.
(iii)	(d) Mg^{+2}	Heat of hydration $\propto$ charge density $= \frac{Charge}{Size}$
(iv)	(d) Radium	Radium is an alkaline earth metal.
(v)	(d) Barium sulphate	Alkali metal sulphates are soluble in water. $ZnSO_4$ is also soluble.
(vi)	(d) None of these metals	Cs is alkali metal and bears resemblance with Li, Na, K, Rb & Fr.
(vii)	(a) $NaNO_3$	$NaNO_3$ is an important ore of Na.
(viii)	(a) Gypsum	Gypsum is important source of calcium.
(ix)	(c) Sodium metal	Down's cell is an electrolytic cell in which Na metal is extracted by the electrolysis of molten NaCl.
(x)	(a) H_2	$2H_2O + 2e \longrightarrow 2OH^- + H_2$ (Cathode)

Previous Boards MCQ's

Which element forms an ion with +3 charge (D.G Khan 2010)
(a) Boron (b) Aluminium (c) Carbon (d) Silicon

2. Which one is more soluble in water? (Rwp 2008)
(a) $Be(OH)_2$ (b) HBO_2 (c) $Ba(OH)_2$ (d) All of these

3. Soda lime is often employed to remove both (Rwp 2010)
(a) H_2O and NO_2 (b) CO and CO_2 (c) H_2O and CO_2 (d) H_2S and CO_2

4. Which is insoluble in water? (Fsd 2008)
(a) CaO (b) SrO (c) BaO (d) MgO

5. Chemical formula of magnesite is (Fsd 2008)
(a) $CaMg_3(SiO_3)_4$ (b) $MgCO_3$ (c) $MgSO_4$ (d) $MgCl_2$

6. Which one does not belong to alkaline earth metals? (Fsd 2009)
(a) Be (b) Ba (c) Ra (d) Rn

7. The element deposited at the Cathode during the electrolysis of brine in diaphragm cell (Fsd 2010)
(a) Na (b) H_2 (c) Cl_2 (d) O_2

8. The only alkaline earth metal which form Peroxide is (Sgr 2009)
(a) Beryllium (b) Magnesium (c) Calcium (d) Barium

9. The sulphate compound insoluble in water is (Sgr 2010)
(a) Barium sulphate (b) Sodium sulphate (c) Potssium sulphate (d) Zinc sulphate

10. Which is not an alkali metal? (Grw 2008)
(a) Francium (b) Caesium (c) Rubidium (d) Radium

11. Which element is not present abundantly in the earth crust? (Grw 2008)
(a) Silicon (b) Aluminium (c) Sodium (d) Oxygen

12. The milk of magnesia is used for the treatment of (Grw 2010)
(a) Acidity (b) Basicity (c) Rancidity (d) Jaundance

13. Indicate amphoteric oxide (Grw 2011)
(a) MgO (b) BeO (c) SrO (d) CaO

14. Dolomite is an ore of (Lhr 2008)
(a) Strontium (b) Magnesium (c) Barium (d) Potassium

15. Chile saltpetre has the chemical formula (Lhr 2009, 2010)
(a) $NaNO_3$ (b) KNO_3 (c) $Na_2B_4O_7$ (d) $Na_2CO_3.H_2O$

16. Oxide used in mountaineer's breathing equipment is (D.G Khan 2010)
(a) Na_2O (b) Na_2O_2 (c) K_2O (d) KO_2

17. Plaster of Paris can be obtained from: (Fsd. 2012)
(a) Marble (b) Bauxite (c) Gypsum (d) Limestone

18. Cement contains gypsum: (Lhr. 2012)
(a) 3% (b) 2% (c) 0.2% (d) 0.3%

Entry Test MCQ's

1. Which among the following is least soluble in water
(a) NaF (b) LiF (c) KF (d) RbF

2. Sodium reacts with water more vigorously than lithium because
(a) It has higher atomic mass (b) It is more electronegative (c) It is more electropositive (d) It is a metal

3. Electrolysis of fused NaCl will give
(a) Na (b) NaClO (c) NaOH (d) $NaClO_3$

4. Which of the following has lowest thermal stability
(a) Li_2CO_3 (b) K_2CO_3 (c) Na_2CO_3 (d) $RbCO_3$

5. When a standard solution of NaOH is left in air for a few hours
(a) A precipitate will form (b) Strength will increase
(c) Strength will decrease (d) Concentration of Na^+ ions will remains constant

6. Which reacts directly with nitrogen to form nitride
(a) Na (b) K (c) Li (d) Rb

Punjab Academy

7. For which one of the following minerals, the composition given is incorrect
(a) Soda ash- Na_2CO_3 (b) Carnallite- $KClMgCl_2.6H_2O$
(c) Borax $Na_2B_4O_7.7H_2O$ (d) Glauber's salt $Na_2SO_4.10H_2O$

8. Which of the following carbonate does not evolve CO_2 on heating
(a) Li_2CO_3 (b) Na_2CO_3 (c) $MgCO_3$ (d) $CaCO_3$

9. Sodium metal cannot be stored under
(a) Hexane (b) Benzene (c) Kerosene (d) Ethanol

10. Hydrogen behaves as an oxidizing agent in its reaction with
(a) Chlorine (b) Nitrogen (c) Potassium (d) Sulphur

11. Which of the following compounds has maximum covalent character
(a) LiF (b) LiCl (c) NaCl (d) CsCl

12. Caustic soda is
(a) Efflorescent (b) Deliquescent (c) Hygroscopic (d) Oxidant

13. Electrolysis of aqueous sodium chloride leads to the formation of
(a) Na and H_2 (b) Na and O_2 (c) Na and Cl_2 (d) H_2 and Cl_2

14. Drying agent which reacts with CO_2 and removes water vapours is
(a) CaO (b) $CaCO_3$ (c) $CaCl_2$ (d) $Ca(NO_3)_2$

15. Which of the following is the most soluble in water
(a) $CaSO_4$ (b) $MgSO_4$ (c) $SrSO_4$ (d) $BaSO_4$

16. If CO_2 is passed in excess into lime water, the milkiness, first formed, disappears due to:
(a) Reversal of original reaction (b) Formation of soluble calcium bicarbonate
(c) Formation of volatile calcium derivative (d) Formation of soluble magnesium hydroxide

17. Mortar is a mixture of
(a) $CaCO_3$ and SiO_2 (b) $CaCO_3$ and clay
(c) CaO and $Ca(OH)_2$ (d) $Ca(OH)_2$, silica and water

18. Compounds of alkaline earth metals are less soluble in water than corresponding alkali metals due to:
(a) Their increased covalent character (b) High lattice energies
(c) Their high ionization potentials (d) Small atomic radius

19. The process of setting of cement under water is essentially
(a) An oxidation process (b) A double decomposition process
(c) A reduction process (d) A hydration process

20. Plaster of Paris hardens by:
(a) Giving off CO_2 (b) Utilizing water (c) Changing into $CaCO_3$ (d) Giving out water

21. Gypsum is added to clinker during cement manufacture to.
(a) Decrease the rate of setting of cement (b) Facilitate the formation of colloidal gel
(c) Bind the particles of calcium silicate (d) All of the above

22. Which of the following pairs of substances gives same gaseous product on reaction with water
(a) Na and Na_2O_2 (b) Sr and SrH_2 (c) Ca and CaH_2 (d) Ba and BaO_2

23. Hydrogen has the tendency to gain one electron to acquire noble gas configuration, in this respect it resembles
(a) Alkali metals (b) Alkaline earth metals (c) Carbon (d) Halogens

24. Which of the following metals will give H_2 on reaction with NaOH
(a) Be (b) Ca (c) Ba (d) Sr

25. ---------is necessary for development of leaves and it tends to accumulate in leaves and bark.
(a) NO_2 (b) Calcium (c) Gypsum (d) Nitrogen

26. Na may be denoted by _____ electron configuration notation
(a) $1s^2 2s^1$ (b) [Ne] $3s^1$ (c) [Ar] $4s^1$ (d) None of these

27. The reaction of an alkali metal oxide with water is:
(a) Complexation reaction (b) Precipitation reaction (c) Redox reaction (d) Acid-base reaction

28. Gypsum is a:
(a) Synthetic polymer (b) Mineral (c) Natural polymer (d) Dead plant material

29. Alkali metals are powerful reducing agents because
(a) These are metals (b) Their ionic radii are large
(c) These are monovalent (d) Their ionization potentials are low

Additional MCQ's

1. Asbestos is the mineral of:
(a) Beryllium (b) Potassium (c) Magnesium (d) Sodium

2. When Lithium is burnt in air, it forms:
(a) Superoxides (b) Acidic oxides (c) Normal oxides (d) Both b and c

3. Lithium salts of anions having high charge density are generally _____ as compared to other alkali metals
(a) More soluble in H_2O (b) Insoluble in H_2O (c) Less soluble (d) Constant solubility

4. With excess of oxygen sodium forms:
(a) Pale yellow normal oxide (b) Pale yellow peroxide
(c) Pale green super oxide (d) Pale green peroxide

5. Ionic hydrides are used as powerful reducing agents due to presence of:
(a) H^+ ion (b) OH^- ion (c) H^- ion (d) None

6. The ease of decomposition of the carbonates of Alkaline earth metal:
(a) Increases down the group (b) Decreases down the group
(c) Decomposition is difficult (d) None

7. The solution of Na_2CO_3 in water is basic due to hydrolysis of:
(a) Carbonate ion (b) Bicarbonate ion (c) Hydroxide ion (d) None

8. The solubility of alkaline earth metals hydroxides increases down the group due to:
(a) Low lattice energy (b) Higher ionic size (c) Both a & b (d) High lattice energy

9. The nitrides of group II-A metals on hydrolysis give:
(a) NH_3 gas (b) NH_3 free radical (c) Respective Hydroxides (d) Both a and C

10. Melting point of NaCl is reduced by adding:
(a) $CaCl_2$ (b) $KMnO_4$ (c) KCl (d) $K_2Cr_2O_7$

11. Which plaster sets very slowly:
(a) Cement plaster (b) Dead burnt (c) Hard finish plasters (d) Plaster of paris

12. Which compound is important in glass industry:
(a) $CaCO_3$ (b) $CaSiO_4$ (c) $CaSiO_3$ (d) SiO_2

13. The lowest electron affinity is possessed by:
(a) Li (b) K (c) Ba (d) Ca

14. Most important commercial source of lithium is:
(a) Spodumene (b) Lithium Sulphate (c) Trona (d) Carnallite

15. Which one of the following is essential constituent of chlorophyll:
(a) Calcium (b) Magnesium (c) Pottasium (d) None

16. Solution that flows out of cathode in diaphragm cell contains:
(a) 11% NaCl & 16% NaOH (b) 9% NaOH & 16% NaCl
(c) 29% NaOH & 19% NaCl (d) 11% NaOH & 16% NaCl

17. Lime in acidic soil increases the amount of soluble:
(a) P (b) Ca (c) N (d) Silicates

18. Slaking of lime is a following type of reaction:
(a) Reversible (b) Endothermic (c) Exothermic (d) Decomposition

19. The anomalous properties of lithium are due to:
(a) High electropositive character (b) High electronegative character
(c) Low electropositivity (d) Both a and b

20. Why halides of Li are more soluble in the organic solvents:
(a) Lithium compounds are covalent (b) Lithium compounds are stable
(c) Lithium compunds non-polor (d) None of them

bhattiAcademy

21. What product is formed when acetylene is passed over sodium:
(a) CO_2 and H_2 gases (b) Sodium acetylide (c) NaOH (d) C_3H_4

22. When Be reacts with NaOH which product is formed:
(a) Na_2O_2 (b) Na_2BeO_2 (c) Na_2CO_3 (d) None

23. Reducing property of an element depends on:
(a) Mass of element (b) Electropositivity
(c) Magnitude of ionization energy (d) Both b & c

24. Which colour of flame is produced when molten sodium burns in chlorine atmosphere:
(a) Red flame (b) Brilliant Yellow flame
(c) Blue flame (d) None

25. Potassium super oxide has a very interesting use in:
(a) Cement (b) Paper Industry (c) Breathing equipments (d) All of them

26. Magnesium is not attacked by:
(a) Cold water (b) Hot water (c) Both (d) None

27. When exposed to air magnesium is quickly coated with layer of:
(a) MgH_2 (b) MgO (c) Mg_3N_2 (d) None

28. Beryllium is only member of group II A which reacts with alkalies to give:
(a) Oxygen (b) Nitrogen (c) Hydrogen (d) Sulpher

29. Nitrates of both alkali & alkaline earth metals are soluble in:
(a) Alkali (b) Water (c) Lime water (d) Alcohol

30. Alkali metal hydroxides are stable to heat except:
(a) $Mg(OH)_2$ (b) LiOH (c) KOH (d) NaOH

31. Sodium amalgam is an alloy of:
(a) Sodium and mercury metals (b) Sodium and lead metals
(c) Lithium and Zirconium Metals (d) Sodium and Zinc metals

32. Which one of the following pairs of metals react directly with nitrogen?
(a) Na and Mg (b) Li and Mg (c) Mg and Ca (d) Li and Be

33. Sodium is manufactured by:
(a) Electrolysis of molten sodium chloride (b) Electrolysis of aqueous sodium chloride.
(c) Reducing sodium oxide with corbon monoxide (d) Heating of sodium hydride.

34. Which one of the following has lowest first ionization energy?
(a) Li (b) Na (c) Rb (d) Cs

35. Mortar can be used in the place of
(a) Glass (b) NaCl (c) Cement (d) Asbestos

36. Both Down's and Nelson's cells are
(a) Galvanic cell (b) Electrolytic cell (c) Both a & b (d) None

ANSWERS TO MCQ'S

Previous Boards MCQ's

Q. No	Answer	Reason
1.	(b) Aluminium	Aluminium loses its three valence electrons and forms stable Al^{3+} ion.
2.	(b) HBO_2	HBO_2 is metaboric acid which forms boric acid (H_3BO_3) with water. $Ba(OH)_2$ is more soluble in water than $Be(OH)_2$ but less than HBO_2.
3.	(c) H_2O and CO_2	Soda lime (NaOH & CaO) removes both H_2O and CO_2 from certain gases or from organic compounds (Decarboxylation)
4.	(d) MgO	Lattice energy $\propto \frac{1}{\text{Solubility}}$ The sizes of Mg^{+2} and O^{-2} ions are comparable so they have high lattice energy and insoluble in water.

5.	(b) $MgCO_3$	Magnesite ($MgCO_3$) is an ore of magnesium.
6.	(d) Rn	Radon (Rn) is a noble gas and not an alkaline earth metal.
7.	(b) H_2	$2H_2O + 2e \longrightarrow 2OH^-_{(aq)} + H_{2(g)}$ (Cathode)
8.	(d) Barium	When barium is heated in air at 500-600°C, it forms peroxide. $Ba + O_2 \xrightarrow{500-600°C} BaO_2$
9.	(a) Barium sulphate	Sodium, zinc and potassium sulphates are soluble in water. $BaSO_4$ is insoluble because in this case sizes of Ba^{+2} and SO_4^{-2} are comparable.
10.	(d) Radium	Radium (Ra) is an alkaline earth metal.
11.	(c) Sodium	Oxygen is most abundant element. After which Si and then Al are abundant.
12.	(a) Acidity.	Milk of magnesia is basic in nature which neutralizes acidity.
13.	(b) BeO	$BeO + H_2SO_4 \longrightarrow BeSO_4 + H_2O$ (Salt) $BeO + 2NaOH + H_2O \longrightarrow Na_2[Be(OH)_4]$
14.	(b) Magnesium	Dolomite is $MgCO_3.CaCO_3$ which is ore of Mg.
15.	(a) $NaNO_3$	$NaNO_3$ is an important ore of sodium (Na) metal.
16.	(d) KO_2	KO_2 has the ability to absorb CO_2 and generate O_2 as $4KO_2 + 2CO_2 \longrightarrow 2K_2CO_3 + 3O_2$
17.	(c) Gypsum	When gypsum is heated above 100°C, it loses three quarters of its water of crystallization and forms plaster of Paris. $2[CaSO_4.2H_2O] \xrightarrow{100°C} (CaSO_4)_2.H_2O + 3H_2O$
18.	(b) 2%	Gypsum is added in cement to increase its setting time.

Entry Test MCQ's

1.	(b) LiF	Lattice energy $\propto \frac{1}{\text{Solubility}}$ LiF has high lattice energy due to small size of Li^+ ion as a result LiF is least soluble in water.
2.	(c) It is more electropositive	Electropositive character increases down the group because ionization energy decreases down the group.
3.	(b) Na	Electrolysis of fused NaCl takes place in Down's cell to get 99% pure Na.
4.	(a) Li_2CO_3	Li_2CO_3 decomposes on heating into Li_2O and CO_2. $Li_2CO_3 \longrightarrow Li_2O + CO_2$
5.	(c) Strength will decrease	It absorbs CO_2 from atmosphere and form Na_2CO_3.
6.	(c) Li	Li is the only alkali metal which reacts with nitrogen to form nitride. $2Li + 3N_2 \longrightarrow 2Li_3N$
7.	(c) Borax $Na_2B_4O_7.7H_2O$	Borax has chemical foranula $Na_2B_4O_7.10H_2O$. It is decahydrated.
8.	(b) Na_2CO_3	Na_2CO_3 is stable towards heat so it does not decompose.
9.	(d) Ethonol	Na – metal is very reactive so it is stored in non-polar solvents like hexane, benzene and kerosene. Ethanol is polar solvent.
10.	(c) Potassium	$H_2 + 2\overset{\cdot}{K} \longrightarrow 2K\overset{\cdot}{H}$ Oxidation of potassium occurs.

Punjab Academy

11.	(a) LiF	Smaller the electronegativity difference between bonded atoms, higher will be covalent character.
12.	(b) Deliquescent	IIA group hydroxides are generally hygroscopic but caustic soda (NaOH) is highly deliquescent.
13.	(b) H_2 and Cl_2	H_2 is formed at cathode and Cl_2 is formed at anode during electrolysis of aqueous sodium chloride in Nelson's cell.
14.	(b) $CaCl_2$	$CaCl_2$ is dehydrating agent which absorbs water from other substances and dry them.
15.	(b) $MgSO_4$	Solubility of alkaline earth metals sulphates decreases down the group.
16.	(b) Formation of soluble calcium bicarbonate.	When CO_2 is passed through $Ca(OH)_2$ milkiness appears due to formation of $CaCO_3$. By passing more CO_2, it disappears due to formation of $Ca(HCO_3)_2$ which is soluble. $CO_2 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$ $CO_2 + CaCO_3 + H_2O \longrightarrow Ca(HCO_3)_2$
17.	(d) $Ca(OH)_2$, silica and water	When freshly slaked lime (one volume), silica (three volumes) and water are mixed, mortar is formed.
18.	(b) High lattice energies	Cationic size of alkaline earth metals is small so their compounds have high lattice energies and are less soluble in water.
19.	(d) A hydration process	When paste of cement in water is allowed to stand, hydration takes place in first 24hours.
20.	(b) Utilizing water	When Plaster of Paris is mixed with half of its weight of water, it forms a viscous mass and then sets into hard porous mass.
21.	(d) All of above	In order to increase setting time, 2% gypsum is added in cement.
22.	(c) Ca and CaH_2	$Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$ $CaH_2 + 2H_2O \longrightarrow Ca(OH)_2 + 2H_2$
23.	(b) Halogens	Halogens gain one electron to acquire noble gas configuration just like hydrogen $F_{(2,7)} + 1e^- \longrightarrow F^-_{(2,8)}$
24.	(a) Be	Be reacts with NaOH $Be + 2NaOH \longrightarrow Na_2BeO_2 + H_2$
25.	(b) Calcium	Calcium is essential for normal development of plants.
26.	(b) $[Ne]\ 3s^1$	$_{11}Na = 1s^2\ 2s^2\ 2p^6\ 3s^1$ and $_{10}Ne = 1s^2\ 2s^2\ 2p^6$
27.	(d) Acid-base reaction	The reaction between Na_2O and water is $Na_2O + H_2O \longrightarrow 2NaOH$ As no more element undergoes a change in its oxidation state so it is not oxidation-reduction reaction but an acid-base reaction.
28.	(b) Mineral	Gypsum is mineral of calcium and has formula $CaSO_4.2H_2O$.
29.	(d) Their ionization potentials are low	$I.E. \propto \frac{1}{\text{Reducing Property}}$ Greater the reducing properties, lower the ionization energies of elements.

Additional MCQ's

1.	(b) Magnesium	Asbestos is $CaMg_3(SiO_3)_4$.
2.	(c) Normal oxides	$4Li + O_2 \longrightarrow 2Li_2O$ (Lithium oxide is a white solid)
3.	(a) Less soluble	Due to small cationic radius, charge density of Li^{+1} is very high than other alkali metal cations. Charge density $\propto$ Lattice energy $\propto \frac{1}{\text{Solubility}}$

4.	(d) Pale yellow peroxide	$2Na + O_2 \longrightarrow Na_2O_2$ (Sodium Peroxide which is pale yellow in colour)
5.	(c) H^- ion	Due to presence of H^- ion they are used as powerful reducing agents.
6.	(b) Decreases down the group	Down the group, the size of cations increase. As a result the cationic and anionic (carbonate) sizes become comparable so salt become more stable.
7.	(a) Carbonate ion	$Na_2CO_3 \longrightarrow 2Na^+ + CO_3^{-2}$ $CO_3^{-2} + 2H_2O \longrightarrow H_2CO_3 + 2OH^-$
8.	(c) Both (a) and (b)	Down the group, size of cations increase due to which hydroxide becomes less stable so lattice energy decreases and it becomes more soluble.
9.	(a) NH_3 gas	$Mg_3N_2 + 6H_2O \longrightarrow 2NH_3 + 3Mg(OH)_2$
10.	(b) $CaCl_2$	$CaCl_2$ acts as a flux and reduces the melting point of NaCl from 801°C to 600°C.
11.	(c) Hard finish plasters	These are made by the calcinations of the anhydrous sulphate with alum or borax. These plasters are set very slowly but give a hard finish.
12.	(c) $CaSiO_3$	$CaSiO_3$ serves an important basis for glass manufacture.
13.	(c) Ba	Electronegativity value decreases down the group and is inversely proportional to size of atom. Ba has largest size among these so has low electronegativity value.
14.	(a) Spodumene	Spodumene is $LiAl(SiO_3)_2$ (Lithium aluminium silicate).
15.	(b) Magnesium	Chlorophyll is a green pigment. It contains Mg metal.
16.	(d) 11% NaOH and 16% NaCl	Evaporation of this solution crystallizes less soluble NaCl which is filtered off.
17.	(a) P	If the soil has sufficient amount of phosphorous, it is alkaline.
18.	(c) Exothermic	The heat content of $Ca(OH)_2$ (Slaked lime) is less than that of CaO (quick lime) so it is an exothermic reaction given by $CaO + H_2O \longrightarrow Ca(OH)_2$
19.	(c) Low electropositivity	Electropositivity character increases down the group, Li is first member of IA group so its electropositivity is lowest.
20.	(a) Lithium compounds are covalent	Lithium has less electropositive character so its compounds are more covalent.
21.	(b) Sodium acetylide	$2Na + C_2H_2 \longrightarrow Na^+C^- \equiv C^-Na^+ + H_2$ Sodium acetylide
22.	(b) Na_2BeO_2	$Be + 2NaOH \longrightarrow Na_2BeO_2 + H_2$
23.	(d) Both (b) and (c)	Greater the electropositivity and lower the ionization energy, greater the reducing property.
24.	(b) Brilliant yellow flame	Na gives flame test.
25.	(c) Breathing equipments	KO_2 reacts with CO_2 to form K_2CO_3 and oxygen gas. $4KO_2 + 2CO_2 \longrightarrow 2K_2CO_3 + 3O_2$ So, KO_2 is used in breathing equipments.
26.	(a) Cold water	Mg only reacts with steam to form MgO. $Mg + H_2O_{(g)} \longrightarrow MgO + H_2$
27.	(b) MgO	Due to formation of MgO, further reaction is not possible.
28.	(c) Hydrogen	$Be + 2NaOH \longrightarrow Na_2BeO_2 + H_2$ (sodium beryllate)
29.	(b) Water	Hydration energy > Lattice energy, So soluble in water.
30.	(b) LiOH	LiOH decomposes on heating into Li_2O as $2LiOH \xrightarrow{\Delta} Li_2O + H_2O$
31.	(a) Sodium and mercury	Sodium reacts with mercury to form sodium amalgum.

bhatia.cc

	metals	
32.	(b) Li and Mg	$6Li + N_2 \longrightarrow 2Li_3N$ $3Mg + N_2 \longrightarrow Mg_3N_2$
33.	(b) Electrolysis of molten sodium chloride	In Down's cell, sodium is manufactured by electrolysis of molten NaCl.
34.	(d) Cs	Cs has lowest ionization energy value due to its large size.
35.	(c) Cement.	Lime morter material when placed between the stones and bricks hardens or sets, thus binding the blocks firmly together.
36.	(b) Electrolytic cells.	In both cells, non–spontaneous redox reactions take place.

Short Answers Questions

1. Why group IA elements are called alkali metal and IIA are called alkaline earth metals? (D.G. Khan 08)

Ans. Alkali metals

The name " alkali" came from Arabic, which means 'The ashes'. The Arabs used this term for these metals because they found that the ashes of some plants were composed chiefly of sodium and potassium. That's why group IA elements are called alkali metals.

Alkaline earth metals

The elements of II A group are called alkaline earth metals. They include Be, Mg, Ca, Sr, Ba and Ra. They are called alkaline earth metals because they produce alkalies in water and are widely distributed in earth's crust in the form of carbonates and silicates.

2. Why the alkali and alkaline earth metals are the most reactive elements of the periodic table? (Lhr 12)

Ans. Reactivity of alkali and alkaline earth metals

The reactivity of an element depends upon its ionization energy. Lesser the ionization energy more will be reactivity of element.

Alkali and alkaline earth metals are very electropositive elements having lower ionization energies values. Therefore, they are considered as the most reactive class of organic compounds. That's why sodium (Na) is stored in kerosene oil as it reacts with both water and air immediately.

3. Write Chemical formulas of (a) Chile salt petre (b) Sylvite (Lhr 10)

Ans. Chemical Formulas of

Name of ores	Formula
Chile Salt Petre	$NaNO_3$
Sylvite	KCl

4. Write down names and formulas of two ores of potassium. (Fsd 08)

Ans. Names and Formulas of Ores of Potassium

Name of ores	Formula
Carnallite	$KCl.MgCl_2.6H_2O$
Alunite (Alum Stone)	$K_2SO_4.Al_2(SO_4)_3.4Al(OH)_3$

5. Why the alkali metals are strong reducing agents? (Lhr 09)

Ans. Reducing property of Alkali Metals:

Reducing property of an element depends upon the ionization energy. Elements with low ionization energy values act as strong reducing agents.

Alkali metals have a tendency to lose electron easily and their ionization energy value is also very low due to which they are strong reducing agents.

6. Give chemical formulas of following minerals. (Rwp 08)

Ans. Chemical Formulas of:

Name of ores	Formula
Beryl	$Be_3Al_2(SiO_3)_6$
Asbestos	$CaMg_3(SiO_3)_4$

7. How $LiNO_3$ and $NaNO_3$ differ on application of heat? Write correspouding chemical equations also. (Lh

Ans. Effect of heat on $LiNO_3$ and $NaNO_3$:

Lithium has less electropositive character therefore its nitrates are not so stable and decompose giving lithia oxide. Decomposition of lithium nitrate ($LiNO_3$) gives different products (on heating) than the nitrates of other alkali metals.

$$4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$$
$$2NaNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$$

8. The reaction of an alkali metal oxide with water is an acid base reaction and not an oxidation reduction reaction. Justify (Mtg 12)

Ans. Reaction of alkali metal oxide with water

Alkali metal oxides dissolve in water to give strongly alkaline solutions. For example

$$Li_2O_{(s)} + H_2O_{(l)} \longrightarrow 2LiOH_{(aq)}$$
$$2Na_2O_{2(s)} + 2H_2O_{(l)} \longrightarrow 4NaOH + O_{2(g)}$$

The reaction of an alkali metal oxide with water is an acid base reaction and not an oxidation reduction reaction because no element undergoes a change in its oxidation state (number). The reaction simply involves the decomposition of water molecule by an oxide ion.

$$O^{-2} + H_2O \longrightarrow 2OH^-$$

9. Why KO_2 is used in breathing equipments for mountaineers and in spacecraft? (Grw 11, Lhr 12)

Ans. KO_2 – Used in breathing equipments

Potassium superoxide (KO_2) has the ability to absorb the carbon dioxide while giving out oxygen at the same time.

$$4KO_{2(s)} + 2CO_{2(g)} \longrightarrow 2K_2CO_{3(s)} + 3O_2$$

That's why KO_2 has a very interesting use in breathing equipments for mountaineers and in space crafts.

10. Justify that BeO is an amphoteric oxide.

Ans. BeO – an amphoteric oxide

"An oxide which acts as a base when reacts with strong acid and as an acid when reacts with strong base is called an amphoteric oxide."

BeO is an amphoteric oxide.

- **With acids,** it behaves as a base and gives salt and water.

$$BeO + H_2SO_4 \longrightarrow BeSO_4 + H_2O$$

- **With Bases,** its behavior is just like acids.

$$BeO + 2NaOH \longrightarrow Na_2BeO_2 + H_2O$$

11. Solution of Na_2O in water is alkaline. Justify the statement. (Lhr 11)

Ans. Solution of Na_2O in water

Na_2O is an alkali metal oxide. Its reaction with water is an acid base reaction and it simply involves the decomposition of water molecule by oxide ion.

$$Na_2O_{(aq)} \longrightarrow 2Na^+ + O^{-2}$$

O^{-2} is unstable and so highly reactive. It has great affinity for proton (H^+) which it takes from water to form hydroxide ions.

$$O^{-2} + H_2O \longrightarrow 2OH^-$$

Due to the formation of OH^- ions, the solution of Na_2O becomes alkaline.

bhattiAcademy

12. Discuss the effect of heat on hydroxides of alkali metals. (Fsd 10)

Ans. Effect of heat on hydroxides of alkali metals

Alkali metal hydroxides are very stable so they do not decompose on heating except LiOH which decomposes on heating, due to difference in cationic and anionic radii.

$$2LiOH_{(aq)} \longrightarrow Li_2O_{(s)} + H_2O_{(l)}$$

13. What is milk of magnesia and give its uses?

Ans. Milk of Magnesia

"A suspension of $Mg(OH)_2$ in water is called milk of magnesia."

- Milk of magnesia is used for treatment of acidity in stomach.

14. All the carbonates of alkaline earth metals are insoluble in water but that of alkali metals are soluble in water except Li_2CO_3 why? (Sgr 09)

Ans. Solubility of carbonates of alkali and alkaline earth metals

The solubility of a substance depends upon the charge densities of its cations and anions. Greater the charge densities, lesser will be the solubility.

Anion in both alkali and alkaline earth metal is same i-e., CO_3^{-2}, the solubility of them depends on cations. The charge densities of alkali metal ions are low(less charge and big size) than that of alkaline earth metals so alkaline earth metals carbonates are insoluble in water while those of alkali metals are soluble except Li_2CO_3 because it is unstable due to very small size of lithium ion (Li^+)

15. What is the effect of heat on nitrates of alkali and alkaline earth metals? (Rwp 09)

Ans. Effect of heat on nitrates of alkali & alkaline earth metals

- Nitrates of Li, Mg, Ca and Ba decompose on heating to give O_2, NO_2 and the metallic oxide.

$$4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$$
$$2Mg(NO_3)_2 \xrightarrow{\Delta} 2MgO + 4NO_2 + O_2$$
$$2Ca(NO_3)_2 \xrightarrow{\Delta} 2CaO + 4NO_2 + O_2$$

- The nitrates of Na and k decompose to give meta nitrite and O_2.

$$2NaNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$$
$$2KNO_3 \xrightarrow{\Delta} 2KNO_2 + O_2$$

16. Name the soluble suplhates of alkaline earth metals.

Ans. Soluble sulphates of alkaline earth metals

$BeSO_4$ and $MgSO_4$ are fairly soluble in water. $CaSO_4$ is slightly soluble in water while $SrSO_4$ and $BaSO_4$ are almost insoluble in water.

17. Why the aqueous solution of Na_2CO_3 is alkaline in nature? (Lhr 10, Mtn 12, Sgr 10, D.G Khan 09)

Ans. Aqueous Solution of Na_2CO_3

Sodium carbonate (Na_2CO_3) is formed by the reaction of sodium hydroxide and carbonic acid. The solution of Na_2CO_3 in H_2O is alkaline in nature due to the hydrolysis of carbonate ion.

$$Na_2CO_3 \rightleftharpoons 2Na^+ + CO_3^{-2}$$
$$CO_3^{-2} + 2H_2O \longrightarrow H_2CO_3 + 2OH^-$$

The hydroxide ions are liberated in water which make the solution basic or alkaline.

18. What happens when CO_2 gas is passed through lime water? Also give chemical equation. (Lhr Sgr 09, Grw 08)

Ans. CO_2 is a passed through lime water

A saturated solution of $Ca(OH)_2$ in water is called lime water. It is used as a test for CO_2. When CO_2 is passed through lime water, calcium carbonate($CaCO_3$) is formed which is insoluble in water and forms precipitates.

$$CO_2 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$$

On further passing of CO_2 from the solution, it forms $Ca(HCO_3)_2$ which is soluble in water so ppt., starts disappearing.

$$CaCO_3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_2$$

19. Why is $CaCl_2$ added in molten NaCl in Down's cell? (Fsd 12)

Ans. Addition of CaCl2 in molten NaCl in Down's Cell

The melting point of sodium chloride (NaCl) is very high i.e., 801°C. Some calcium chloride ($CaCl_2$) it as a flux to lower the melting point of NaCl and to permit the furnace at about 600°C.

20. Write down the advantages of Down's Cell. (Fsd 08, Lhr 12, Rwp 07, 09)

Ans. Advantages of Down's Cell

i) The metallic fog is not produced.
ii) Liquid sodium can easily be collected at 600°C.
iii) Material of the cell is not attacked by the products formed during the electrolysis.
iv) Dry chlorine and 99.9% pure sodium is obtained.

21. What are two major problems faced during working of diaphragm cell? (Lhr 12, D.G. Khan 08, 09)

Ans. Problems during working of Cell

We can face two major problems during the working of Cell.

1) Chlorine produced can react with hydroxide ions in cold giving hypochlorite ions (cause rusting of steel tank)

$$Cl_{2(g)} + 2OH^-_{(aq)} \longrightarrow \underset{\text{Hypochlorite ions}}{OCl^-_{(aq)}} + Cl^-_{(aq)} + H_2O$$

2) Hydroxide ions may be attracted towards anode, where they can be discharged releasing oxygen gas. This oxygen gas may contaminate the chlorine and renders it impure.

$$4OH^- \longrightarrow 2H_2O + O_2 + 4e^-$$

22. Point out the role of gypsum in agriculture. (Lhr 12, Fsd 10)

Ans. Role of Gypsum in Agriculture

Gypsum is supplied to the soil as a source of calcium and sulphur. The calcium supplied by gypsum in fertilizers is of importance in crop production in area where soils are subjected to extensive leaching. Importance of sulphur in plant growth.

- It has been recognized as an essential constituent of plants.
- It serves as a constituent of proteins and various other compounds in plants.
- It has influence on chlorophyll development in plant leaves. Plants deficient in sulphur exhibit a pale green colour.
- The roots system of several plants has been observed to be greatly enlarged by the applications of sulphur.

23. What is meant by dead burnt? (Grw 09)

Ans. Dead Burnt

When gypsum is strongly heated at 400°C, it forms anhydrous salt which absorbs water slowly. Such plaster is called "Dead Burnt."

$$\underset{\text{Gypsum}}{CaSO_4.2H_2O} \longrightarrow \underset{\text{Dead burnt}}{CaSO_4} + 2H_2O$$

24. How plaster of Paris is formed? Give its uses. (Fsd 12, Lhr 12)

Ans. Plaster of Paris

When gypsum is heated under carefully controlled conditions at 100°C, it loses three quarter of water of crystallization. The resulting product is called plaster of Paris.

$$\underset{\text{Gypsum}}{2[CaSO_4.2H_2O]} \longrightarrow \underset{\text{Plaster of Paris}}{(CaSO_4)_2.H_2O} + 3H_2O$$

Uses

i) It is used for making plaster walls, casts of statuary, coins, etc.
ii) It is used in surgery, plaster of Paris bandages are used for holding in place fractured bones after they have been set.
iii) Special plasters contain plaster of Paris and other ingredients which vary with the demands of the use to which they are to be put.

Punjab Academy

25. **Why 2% gypsum is added in the cement "OR" What is the role of gypsum in cement industry?** **(Sgr 10, Lhr 08, Fsd 08)**

Ans. Role of gypsum in cement:

Portland cement is made by strongly heating a finely powdered mixture of clay (argillaceous) and limestone (calcarious). The final product, known as clinker, is cooled and then ground into a very fine powder. During the grinding there is added about 2% of gypsum which prevents the cement from hardening too rapidly. The addition of gypsum increases the setting time of cement.

26. **Point out role of limein agriculture.** **(D.G. Khan 10)**

Ans. Role of Lime in agriculture

- Large quantities of calcium oxide (CaO) are used in agriculture for neutralizing acidic soils. It has been found that application of lime to acidic soils increases the amount of readily soluble phosphorous.
- Calcium oxide is used in large amounts for making lime-sulphur sprays which have a strong fungicidal action.
- The hydroxide of calcium is obtained when the oxide of the calcium is allowed to react with water. The process is called slaking of lime and it is an exothermic reaction.

$$\underset{\text{Quick Lime}}{CaO} + H_2O \longrightarrow \underset{\text{Slaked Lime}}{Ca(OH)_2}$$

27. **Why Calcium is essential for the normal development of plants?** **(FSd 12, Lhr 12)**

Ans. Role of Calcium in Plant Growth

The presence of calcium is essential for the normal development of plants. The quantity of calcium required by different plants varies considerable. Its main functions are

(i) An adequate supply of calcium appears to stimulate the development of root hairs and in fact, the entire root system.

(ii) It is necessary for normal leave development and tends to accumulate in leaves as well as in bark.

(iii) An adequate supply of calcium on the supply of available phosphorus in the soil is of special significance. Soils containing sufficient calcium are slightly alkaline in nature.

28. **Why lime is added to acidic soil?** **(Fsd 12)**

Ans. Addition of lime to acidic soil

Large quantities of calcium oxide (CaO) are used in agriculture for neutralizing acidic soils.
It has been found that application of lime to acidic soils increases the amount of readily soluble phosphorus.

29. **How lime mortar is prepared?** **(Lhr 12) (FSd 10) (Rwp 08)(Fsd 09) (Grw 10)**

Ans. Preparation of Lime Mortar

Ordinary mortar, also called lime mortar, is prepared by mixing freshly slaked lime (One volume) with sand (three or four volumes) and water to form a thick paste. This material when placed between the stones and bricks hardens or sets, thus binding the blocks firmly together. The equations for the chemical reactions that take place when mortar hardens are

$$CaO + H_2O \longrightarrow Ca(OH)_2$$
$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$
$$Ca(OH)_2 + SiO_2 \longrightarrow CaSiO_3 + H_2O$$

****

CHAPTER 3

Group IIIA And Group IVA Elements

Solved Objective Exercise

Q1. Fill in the blanks.

(i) _____ acid has chemical formula HBO_2.
(ii) Aluminium normally occurs as _____ minerals found in the rock of outer portion of the earth.
(iii) Aluminium gives _____ gas with hot concentrated H_2SO_4.
(iv) Boron forms _____ bond in its compounds.
(v) The chemical formula of white lead is _____.
(vi) _____ is the only element with less than four electrons in the outer most shell that is not metal.
(vii) In the Group IIIA of the periodic table, _____ is a semi-metal.
(viii) Borax that occurs as a natural deposit, is called _____.
(ix) Cryolite is an important mineral of aluminium and its formula is _____.
(x) A _____ is a substance that has different resistances to the passage of an electric current under different circumstances.

Answer Key.

(i)	Metaboric acid	(ii)	Alumino silicate
(iii)	SO_2	(iv)	Covalent
(v)	$2PbCO_3 \cdot Pb(OH)_2$	(vi)	Boron
(vii)	Boron	(viii)	Tincal
(ix)	Na_3AlF_6	(x)	Semi conductor

Q2. Indicate True Or False.

(i) Boron always uses all the three of its valence electrons for bonding purposes.
(ii) Diaspore is an ore of carbon.
(iii) Emerald is an ore of aluminum that has the chemical formula $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$.
(iv) An aqueous solution of borax is feebly acidic in nature
(v) In case of borax bead test, of Cupric oxide, the beads are coloured blue in the reducing flame.
(vi) Boric acid can be titrated with sodium hydroxide.
(vii) Carbon and silicon are the only non-metals in Group IVA.
(viii) PbO is commonly known as litharge.
(ix) Basic lead carbonate is a reddish brown pigment.
(x) Aluminium oxide (Al_2O_3) is also called bauxite.

Answer Key.

(i)	True	(ii)	False	(iii)	False	(iv)	False	(v)	False
(vi)	True	(vii)	True	(viii)	True	(ix)	False	(x)	False

bhatti Academy

Q3. Multiple Choice Questions. Encircle the correct answer.

(i) Which metal is used in the thermit process because of its activity:
(a) Iron (b) Copper (c) Aluminium (d) Zinc

(ii) Aluminum oxide is:
(a) Acidic oxide (b) Basic oxide (c) Amphoteric oxide (d) None of these

(iii) Chemical compositions of colemanite is:
(a) $Ca_2B_6O_{11}.5H_2O$ (b) $CaB_4O_7.4H_2O$
(c) $Na_2B_4O_7.4H_2O$ (d) $CaNaB_5O_9.8H_2O$

(iv) Which element forms an ion with charge + 3:
(a) Beryllium (b) Aluminium (c) Carbon (d) Silicon

(v) Which electronic configuration corresponds to an element of Group – IIIA of the periodic table
(a) $1s^2,2s^2,2p^6,3s^2,3p^1$ (b) $1s^2,2s^2,2p^6,3s^2,3p^6,4s^2$
(c) $1s^2,2s^2,2p^6$ (d) $1s^2,2s^2,2p^6,3s^2,3p^3$

(vi) Which element among the following belongs to Group IVA of the periodic table:
(a) Barium (b) Iodine (c) Lead (d) Oxygen

(vii) Boric acid cannot be used:
(a) as antiseptic in medicine (b) for washing eyes
(c) in soda bottles (d) for enamels and glazes

(viii) Which of the following elements is not present abundantly in earth's crust?
(a) Silicon (b) Aluminium (c) Sodium (d) Oxygen

(ix) Tincal is a mineral of:
(a) Al (b) B (c) Si (d) C

(x) The chief ore of aluminium is:
(a) Na_3AlF_6 (b) $Al_2O_3.2H_2O$ (c) Al_2O_3 (d) $Al_2O_3.H_2O$

Solved Exercise MCQ's

Q. No	Answer	Reason
(i)	(c) Aluminium	Aluminium has the tendency to react with both O_2 and N_2 so it reacts with air. The reaction is exothermic so used in thermite process.
(ii)	(c) Amphoteric oxide	Al_2O_3 reacts with acids as base and with bases as acid.
(iii)	(a) $Ca_2B_6O_{11}.5H_2O$	Colemanite is important mineral of B used to manufacture borax.
(iv)	(b) Aluminium	Aluminium loses 3 of its valence electrons to form Al^{+3} ion.
(v)	(a) $1s^2\ 2s^2\ sp^6\ 3s^2\ 3p^1$	Valence shell electronic configuration of Group-III A elements is ns^2np^1.
(vi)	(c) Lead	Group-IVA elements are C, Si, Ge, Sn and Pb.
(vii)	(c) In soda bottles	CO_2 is used in soda bottles and boric acid is not used.
(viii)	(c) Sodium	O. Si and Al are most abundant in earth's crust.
(ix)	(b) B	Tincal is natural deposit of borox.
(x)	(b) $Al_2O_3.2H_2O$	Bauxite ($Al_2O_3.2H_2O$) is the chief ore of aluminium

Previous Boards MCQ's

1. The aqueous solution of borax is (D.G Khan 2008)
(a) Alkaline (b) Acidic (c) Amphoteric (d) Neutral
2. When H_3BO_3 reacts with NaOH, salt mostly formed is (D.G Khan 2009)
(a) Na_3BO_3 (b) $Na_2B_4O_7$ (c) NaH_2BO_3 (d) $NaBO_2$
3. Which one is more stable? (Rwp 2008)
(a) H_3BO_3 (b) HBO_2 (c) $H_2B_4O_7$ (d) $H_6B_4O_9$
4. Basic lead chromate is formed when lead chromate is boiled with (Grw 2010)
(a) Dilute alkali hydroxide (b) Dilute acid (c) Strong alkali hydroxide (d) Strong acid
5. Asbestos is commonly used in making (Rwp 2010)
(a) Wall board (b) Black board (c) Soft board (d) Hard board
6. Aluminium oxide is (Fsd 2009, Grw 2009)
(a) Acidic oxide (b) Basic oxide (c) Amphoteric oxide (d) None of these
7. The bond in $SiCl_4$ is (Fsd Sup 2010)
(a) Ionic (b) Partly ionic (c) Covalent (d) Partly covalent
8. The formula of asbestos is (Fsd Sup 2010)
(a) $CaMg_3(SiO_3)_4$ (b) $CaMg(SiO_3)_3$ (c) $CaMg(SiO_3)_2$ (d) $CaMgSiO_3$
9. The observed bond distance in C-O in CO_2 is (Fsd Sup 2010)
(a) 105 pm (b) 110 pm (c) 115 pm (d) 120 pm
10. The compound which forms bead in Borax bead test is (Sgr 2009)
(a) Metal oxide (b) Metal boride (c) Metal borate (b) Metal meta borate
11. The metal which does not give borax bead test is (Sgr 2010)
(a) Cu (b) Cr (c) Ni (d) Al
12. Orthoboric acid when heated to red hot gives (Grw 2011)
(a) Boric anhydride (b) Pyroboric acid (c) Metaboric acid (d) Tetraboric acid
13. In borax bead test, when borax is heated with cobalt oxide, it forms bead of (Lhr 2008)
(a) Black colour (b) Blue colour (c) Red colour (d) Green colour
14. Boric acid cannot be used (Lhr 2010)
(a) As antiseptic in medicine (b) For washing eyes (c) In soda bottles (d) For enamels and glazes
15. Following is used in making fire proof clothes (Lhr 2011)
(a) Water glass (b) Borax glass (c) Kaolin (d) Asbestos
16. Which metal is used in the flash light photography because of its activity? (Fsd. 2012)
(a) Iron (b) Copper (c) Aluminium (d) Zinc
17. Dolomite is: (Lhr. 2012)
(a) $CaCO_3$ (b) $MgCO_3.CaCO_3$ (c) $MgCO_3$ (d) Na_2CO_3
18. Tincal is a mineral of: (Lhr. 2012, Grw
(a) Aluminium (b) Boron (c) Silicon (d) Carbon

Entry Test MCQ's

1. Basicity of orthoboric acid (H_3BO_3) is
(a) One (b) Three (c) Two (d) Ze
2. Which of the following is not a mineral of aluminium
(a) Cryolite (b) Feldspar (c) Mica (d) F
3. Aluminium does not react with
(a) NaOH (b) N_2 (c) HCl (d)

bnatta Academy

When aluminium is heated in atmosphere of nitrogen forms a nitride of formula
(a) AlN (b) AlN_3 (c) Al_3N (d) Al_2N_3

Which of the following oxide is acidic as well as solid at room temperature
(a) SiO_2 (b) PbO_2 (c) CO_2 (d) SnO_2

Orthoboric acid on strong heating to red hot gives
(a) Borax (b) Metaboric acid (c) Tetraboric acid (d) Boron trioxide

Inorganic graphite is
(a) $B_3N_3H_6$ (b) SiC (c) B_3N_3 (d) P_4S_3

Borax is used as a cleansing agent because on dissolving in water, it gives
(a) Alkaline solution (b) Bleaching solution (c) Acidic solution (d) Neutral solution

Which of the following has the lowest melting point
(a) B (b) Ga (c) Al (d) Tl

Which of the following is acidic in nature
(a) $Be(OH)_2$ (b) $Al(OH)_3$ (c) $Mg(OH)_2$ (d) $B(OH)_3$

Which one of the statement is correct for Al metal
(a) It is a bad conductor of electricity (b) Alloys of Al are heavy
(c) It is malleable and ductile (d) It is found free in nature

Alums are used for
(a) Tanning of leather (b) Purification of water
(c) Coagulation (d) All of these

Boric acid is prepared from borax by the action of
(a) Hydrochloric acid (b) Carbon dioxide (c) Sodium hydroxide (d) Sodium carbonate

Silica is reacted with sodium carbonate. What is the gas liberated
(a) CO (b) CO_2 (c) O_2 (d) O_3

What is the general electronic configuration of Group IVA elements
(a) ns^2np^1 (b) ns^1np^1 (c) ns^2np^2 (d) ns^2

Which of the following is a semiconductor
(a) C (b) Ge (c) Pb (d) Sn

Red lead is:
(a) PbO (b) Pb_3O_4 (c) PbO_2 (d) $PbCrO_4$

Which is not used as a pigment in paints
(a) $PbCrO_4$ (b) White lead (c) PbO_2 (d) Pb_3O_4

Lead pencil contains
(a) Graphite (b) Charcoal (c) Lead (d) Lead sulphite

Which metal is commonly used to remove air bubbles from molten metals?
(a) Aluminum (b) Copper (c) Sodium (d) Calcium

$Al_2F_2SiO_4$ is named as
(a) Gibbsite (b) Emerald (c) Bauxite (d) Cryolite

Additional MCQ's

What makes boron non-metallic?
(a) Large size (b) Low ionization energy
(c) Small size & high nuclear charge (d) All of these

The irregularity in group IIIA elements in atomic size is due to:
(a) Presence of s electrons (b) Presence of p-electrons
(c) Presence of d electrons in heavier members (d) None of these

3. The higher ionization energy in group III-A is of:
(a) Aluminium (b) Gallium (c) Boron (d) Indium

4. The density of group III-A elements:
(a) Decreases down the group (b) Increases down the group
(c) Remains same throughout the period (d) None of these

5. The largest ionic radius is of:
(a) Boron (b) Aluminium (c) Gallium (d) Thalium

6. Boron occurs principally as salts of:
(a) Polyboric acids (b) Metallic acids (c) Non-Metallic (d) Both a & b

7. Which one is the ore of boron?
(a) Mica (b) Bauxite (c) Cryolite (d) Colemanite

8. Borax is the sodium salt of:
(a) Acetic acid (b) Tetraboric acid (c) Orthoboric acid (d) Both a & c

9. Boron usually exhibits oxidation states:
(a) +2 and -2 (b) +3 and -3 (c) +1 and -1 (d) +4 and -4

10. Boron does not form ionic compounds with:
(a) Sulphate (b) Nitrate (c) Anions (d) all

11. Borax is more soluble in:
(a) Cold water (b) Hot water (c) Water (d) Ice

12. $Na_2B_4O_7.5H_2O$ have .... crystal at above 62°C during crystallization:
(a) Tetrahedral (b) Octahedral (c) Pentahedreal (d) Cubic

13. 100 g of water dissolve 3g of decahydrate at 10°C and saturated solution allowed to crystallize below 62°C ..... formed:
(a) Pentahydrate (b) Octahydrate (c) Decahydrate (d) Tetrahydrate

14. Formula of metaboric acid:
(a) H_3BO_3 (b) HBO_2 (c) $H_2B_2O_7$ (d) $H_6B_2O_7$

15. H_3BO_3 sparingly soluble in cold water at:
(a) 2.6% at 25°C (b) 3.6% at 40°C (c) 2.6% at 40°C (d) 37% at 107°C

16. In the presence of ..... boric acid can be titrated against a standard alkali:
(a) Alcohol (b) Soda ash (c) NaCl (d) Glycerol

17. Boric Acid is used in:
(a) Medicine (b) Pottery as glaze (c) Candle industry (d) All of these

18. Nitric acid is frequently transported in container made up of :
(a) Aluminium (b) Sodium (c) Potassium (d) Iron

19. The elements of group IV-A form oxides of type:
(a) MO_2 (b) M_2O (c) MO_4 (d) M_2O_3

20. The elements of group IV-A form hydrides of type:
(a) M_2H_2 (b) MH_4 (c) M_3H_4 (d) M_4H_2

21. Carbon and silicon form:
(a) Acidic oxides (b) Basic oxides (c) Amphoteric oxides (d) None of these

22. Non metals of group IV-A are:
(a) C and Si (b) Ge and Si (c) P and Si (d) Ge and Pb

23. Oxides of Ge, Pb and Sn are:
(a) Acidic (b) Basic (c) Amphoteric (d) None

24. Aluminium dissolves both acids and bases and liberate gas:

bhatti Academy

(a) Hydrogen (b) Carbon dioxide (c) Carbon monoxide (d) Ozone

25. Boiling point of Ge is greater than:
(a) Sn (b) Si (c) Pb (d) All of these

26. Aluminium dissolves in both sodium and potassium hydroxide to form:
(a) Soluble hypochlorite (b) Soluble hydroxide (c) Aluminium hydroxide (d) Soluble aluminate

27. The molecule of carbon monoxide has a dipole moment:
(a) 0.112 D (b) 0.110 D (c) 0.113 D (d) 0.116 D

28. Dipole moment of the CO_2 molecule is:
(a) 120 D (b) 140 D (c) 106 D (d) Zero D

29. Vitreous silica is not:
(a) Conductor (b) Brittle (c) Insoluble in water (d) Dissolved in HF

30. Vitreous silica is resistant towards all acids except:
(a) HF (b) H_2SO_4 (c) HCl (d) HNO_3

31. In silicon network every silicon atom bonded with oxygen:
(a) Divalent (b) Covalent (c) Tetrahedrally (d) Ionic

32. Silica glass is a:
(a) Rigid (b) Water soluble (c) Soft (d) None of these

33. Sodium silicate solution is strongly:
(a) Alkaline (b) Basic (c) Acidic (d) Both a & b

34. Sodium silicate is used as a:
(a) Filler for soap (b) In Calico printing (c) Furniture polish (d) All of these

35. Pure clay is used to make:
(a) Porcelain (b) China wares (c) Soap (d) Both a & b

36. Impure clay can be more easily fused because they contain oxides of:
(a) Iron (b) Magnesium (c) Calcium (d) Al

37. The name of talc is:
(a) Calcium silicate (b) Aluminium silicate (c) Magnesium silicate (d) Sodium silicate

38. When $SiCl_2(CH_3)_2$ is allowed to react with H_2O then the product formed comes out:
(a) SiO_2 (b) HCl (c) CH_3COOH (d) None

39. When a semiconductor absorbs light electrons become mobile and conductivity:
(a) Decreases (b) Stable (c) No effect (d) Increases

40. Semiconductors include the elements:
(a) Silicon (b) Germanium (c) Selenium (d) All of them

41. Silicones are extensively used in:
(a) Resistors (b) Electrical insulators (c) Oily liquids (d) None of them

42. Which is called litharge or massicot:
(a) PbO (b) Pb_2O (c) Pb_3O_4 (d) PbO_2

43. Boiling litharge with water and olive oil we get:
(a) Lead carbonate (b) Red lead (c) Lead oxalate (d) None of them

44. Pb_3O_4 is used as:
(a) White pigment (b) Red pigment (c) Blue Pigment (d) Silver pigment

45. The formula of basic lead carbonate is:
(a) $PbCrO_4$ (b) Pb_2O (c) Pb_3O_4 (d) $2PbCO_3.Pb(OH)_2$

46. Pb_3O_4 is used in:
(a) Olive oil (b) Rubber industry (c) Colouration (d) Ceramic glazes

47. PbO_2 gets dissolved in:
(a) Acids (b) Alkaline water (c) Both a & b (d) None of them

48. The formula of lead chromate is:
(a) PbO (b) Pb_2O (c) $PbCrO_4$ (d) PbO_2

49. Lead chromate is mixed with lead sulphate it is used as:
(a) Red pigment (b) White pigment (c) Yellow pigment (d) None of them

50. Which one of the following dry tests is used only for the identification of coloured ions:
(a) Flame test (b) Borax bead test (c) Charcoal cavity test (d) Filter ash test

51. Aluminium does not corrode because:
(a) It is a semi-metal (b) It is a silver shining metal
(c) It does not react with O_2 (d) It forms a protective layer of Al_2O_3

ANSWERS TO MCQ'S

Previous Boards MCQ's

Q. No	Answer	Reason
1.	(a) Alkaline	$Na_2B_4O_7 + 7H_2O \longrightarrow 4H_3BO_3 + 2NaOH$. Due to formation of strong alkali, the solution is alkaline.
2.	(b) $Na_2B_4O_7$	$4H_3BO_3 + 2NaOH \longrightarrow Na_2B_4O_7 + 7H_2O$
3.	(a) H_3BO_3	H_3BO_3 is stable. Others are stable in solid state and changed into H_3BO_3 in solution.
4.	(a) Dilute alkali hydroxide.	Basic lead chromates are of orange or red colour.
5.	(d) Hard board.	Absbestos is calcium magnesium silicate i.e., $CaMg_3(SiO_3)_4$
6.	(c) Amphoteric oxide	Al_2O_3 acts as base with acids and as acid with bases.
7.	(d) Partly covalent	The lattice of $SiCl_4$ consists of discrete molecules which are highly polar so, bonds in $SiCl_4$ is partly covalent.
8.	(a) $CaMg_3(SiO_3)_4$	Asbestos is also called calcium magnesium silicate.
9.	(c) 115pm	CO_2 exists in the gaseous state as linear molecule.
10.	(b) Metal meta borate.	Boric anhydride (B_2O_3) reacts with metal oxide to form metal meta borate which forms beads having specific colour.
11.	(d) Al	Transition metals give this test.
12.	(a) Boric anhydride	$H_3BO_3 \xrightarrow{100^\circ C} HBO_2 + H_2O$ (Metaboric acid) $4HBO_3 \xrightarrow{140^\circ C} H_2B_4O_7 + H_2O$ (Tetraboric acid) $H_2B_4O_7 \xrightarrow{\text{Red Hot}} 2B_2O_3 + H_2O$ (Boric anhydride)
13.	(b) Blue colour	The cobalt oxide combines with B_2O_3 to give blue coloured cobalt meta borate, both in oxidizing and reducing flame $CoO + B_2O_3 \longrightarrow Co(BO_2)_2$
14.	(c) In soda bottles.	Boric acid is not used in soda bottles.
15.	(a) Water glass.	Water glass (Na_2SiO_3) is used in textile as a fire proof.
16.	(c) Aluminium	Aluminium reacts with air to form oxide and nitride. The reaction is highly exothermic so Aluminium is used in flash light photography.
17.	(b) $MgCO_3.CaCO_3$	Dolomite is mineral of magnesium and calcium.
18.	(b) Boron	Tincal is natural deposit of borax.

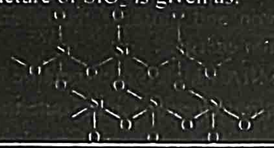
bhatti Academy

Entry Test MCQ's

1.	(a) One	H_3BO_3 is a weak acid and ionizes to a very limited extent mainly as mono basic acid. $H_3BO_3 + H_2O \longrightarrow [B(OH)_4]^- + H^+$
2.	(d) Fluorospar	Fluorospar is the ore of fluorine and calcium. Its formula is CaF_2.
3.	(d) HNO_3	HNO_3 is said to render aluminium passive. So aluminium containers are used for HNO_3 transportation
4.	(a) AlN	$2Al + N_2 \longrightarrow 2AlN$
5.	(a) SiO_2	SiO_2 is acidic and solid due to its polymerized nature.
6.	(d) Boron trioxide	H_3BO_3 on heating to red hot gives boric anhydride (B_2O_3) which is boron trioxide.
7.	(c) B_3N_3	B_3N_3 has hexagonal structure like that of graphite so it is called inorganic graphite.
8.	(a) Alkaline solution.	Borax reacts with water to form strong alkali (NaOH) so due to alkaline solution it is used as cleansing agent. $Na_2B_4O_7 + 7H_2O \longrightarrow 2NaOH + 4H_3BO_3$
9.	(b) Ga	Melting point of Ga is 30°C which is lowest among members of its own group.
10.	(d) $B(OH)_3$	$B(OH)_3$ or H_3BO_3 is orthoboric acid.
11.	(c) It is malleable and ductile	It is a metal so it is malleable and ductile.
12.	(d) All of these	$K_2SO_4 . Al_2(SO_4)_3 . 24H_2O$
13.	(a) Hydrochloric acid.	$Na_2B_4O_7 + 2HCl + 5H_2O \longrightarrow 2NaCl + 4H_3BO_3$
14.	(b) CO_2	$Na_2CO_3 + SiO_2 \longrightarrow Na_2SiO_3 + CO_2$
15.	(c) ns^2np^2	Group-IV A elements have four electrons in their valence shell so their valence shell configuration is ns^2np^2
16.	(b) Ge	Ge and Si are semi-conductors.
17.	(b) Pb_3O_4	Red lead (Pb_3O_4) is also called minium or sindhur.
18.	(c) PbO_2	$PbCrO_4$, white lead and Pb_3O_4 are used as yellow, white and red pigments respectively in paints.
19.	(a) Graphite	Graphite is an allotrope of carbon.
20.	(a) Alminium	Aluminium reacts with both oxygen and nitrogen to form oxide and nitride so it is used to remove air bubbles
21.	(b) Emerald	Emerald is an important ore of aluminium

Additional MCQ's

1.	(c) Small size and high nuclear charge.	Boron has very small size and nuclear charge is very high.
2.	(c) Presence of d-electrons in heavier members.	This is due to the presence of d electrons in heavier members which have poor shielding effect than s and p electrons.
3.	(c) Boron	Boron has high ionization energy value due to its small size.
4.	(b) Increases down the	Due to increase in atomic masses, density increases down the group.

	group.	
5.	(d) Thalium	Ionic radius increase down with group.
6.	(a) Polyboric acids.	H_3BO_3, $H_2B_4O_7$ etc are polyboric acids.
7.	(d) Colemanite	Colemanite is $Ca_2B_6O_{11}.5H_2O$.
8.	(b) Tetraboric acid	$H_2B_4O_7$ is tetraboric acid. Its sodium salt is borax ($Na_2B_4O_7$)
9.	(b) +3 and –3	BF_3 (B = +3), Mg_3B_2 (B = –3)
10.	(d) All	Boron does not form a stable cation due to small size and highest ionization energy.
11.	(b) Hot water	3g in 100g at 10°C and 99.3g in 100g at 100°C.
12.	(b) Octahedral	Above 62°C, octahedral crystals of pentahydrate are formed $Na_2B_4O_7.5H_2O$.
13.	(c) Decahydrate	Below 62°C, decahydrate ($Na_2B_4O_7.10H_2O$) is formed having trielinic structure.
14.	(b) HBO_2	H_3BO_3 = Orthoboric acid. $H_2B_4O_7$ = Tetraboric acid. $H_4B_2O_5$ = Pyroboric acid.
15.	(c) 2.6% at 40°C.	H_3BO_3 is sparingly soluble in water at 40°C i.e., 2.6% and more soluble in water at 107°C (37%)
16.	(d) Glycerol	Hydrolysis of borax is prevented in the presence of glycerol, as borax forms glyceroborate with glycerol.
17.	(b) All	All the three are uses of boric acid.
18.	(a) Aluminium containers	Aluminium does not react with HNO_3.
19.	(a) MO_2	CO_2, SiO_2, GeO_2, SnO_2 and PbO_2.
20.	(b) MH_4	CH_4, SiH_4, GeH_4 etc.
21.	(a) Acidic oxides	CO_2 and SiO_2 are acidic as they give acids in water.
22.	(a) C and Si	Ge, Sn, Pb are metalloids.
23.	(c) Amphoteric	CO_2 and SiO_2 are acidic oxides while GeO_2, SnO_2 and PbO_2 are amphoteric oxides.
24.	(a) Hydrogen	$2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$ $2Al + 2NaOH + 6H_2O \longrightarrow 2NaAl(OH)_4 + 3H_2$
25.	(d) All of these	Elements: Si, Ge, Sn, Pb Boiling points: 2355°C, 2830°C, 2270°C, 1750°C
26.	(d) Soluble aluminate	$2Al + 2NaOH + 6H_2O \longrightarrow 2NaAl(OH)_4 + 3H_2$
27.	(a) 0.112D	CO is slightly polar in nature.
28.	(d) Zero	In CO_2, the two dipoles cancel each other so, Dipole Moment = 0 O ⟸ C ⟹ O $\mu = 0$
29.	(a) Conductor	Vitreous silica is electrically insulator.
30.	(a) HF	HF has the ability to dissolve glass or vitreous silica.
31.	(c) Tetrahedrally.	The structure of SiO_2 is given as: 

Bhatti Academy

		Each Si is attached with oxygen tetrahedrally.
32.	(d) None of these	Silica glass is hard, insoluble in water and insulator.
33.	(a) Alkaline	Na_2SiO_3 solution is strongly alkaline due to hydrolysis. $Na_2SiO_3 + 2H_2O \longrightarrow 2NaOH + H_2SiO_3$
34.	(d) All of these	Sodium silicate (Na_2SiO_3) is used as a filler for soap in soap industry, as furniture polish and in calico printing. It is also called water glass or soluble glass.
35.	(d) Both (a) and (b)	Porcelain and China wares are made by pure clay which has the formula $Al_2O_3.2SiO_2.2H_2O$
36.	(d) All	Due to presence of oxides it is impure.
37.	(c) Magnesium silicate	Talc or soap stone is $H_2Mg_3(SiO_3)_4$ which is magnesium silicate.
38.	(b) HCl	$Cl-Si(CH_3)_2-Cl + 2H_2O \longrightarrow HO-Si(CH_3)_2-OH + 2HCl$
39.	(d) Increases	Semi-conductors are sensitive to light when light falls on them, conductivity increases. This behaviour is opposite to metals.
40.	(d) All of them	Ge, Si, Se are elements which formed semi conductor.
41.	(b) Electrical insulators.	Silicones are electrically insulators.
42.	(a) PbO	It is also called lead monoxoide.
43.	(d) None of them.	Boiling litharge with water and olive oil we get lead oleate which is $C_{17}H_{33}COO^-Pb^+$
44.	(b) Red pigment	Pb_3O_4 is red lead or minium.
45.	(d) 2 $PbCO_3.Pb(OH)_2$	It is an amorphous white pigment.
46.	(d) Ceramic glazes	Pb_3O_4 is called Red lead, minium or sindhur.
47.	(b) Alkaline water	PbO_2 dissolves in alkaline water to form soluble plumbates.
48.	(c) $PbCrO_4$	It is also called chrome yellow.
49.	(d) If forms a protective layer of Al_2O_3	Al_2O_3 is not attacked by further oxygen.
50.	(b) Borax bead test	Metal meta borates are formed which are coloured beads. These colours are different for different metals.

Short Answers Questions

1. Point out how boron is different from its own group. (Lhr 12, Grw 11)

Ans. Peculiar Behaviour of Boron

Boron is the first member of the Group IIIA. It shows many dissimilarities with the members of its own group. The difference in the properties of boron and those of the other members of the series is mainly due to the large difference in their sizes and ionization energies.

1. Boron is the only element in Group IIIA which is non-metallic in behaviour.
2. It is the only element with less than four electrons in the outermost shell which is not a metal.

3. Boron always uses all the three of its valence electrons for bonding purposes and its common oxidation states are +3 and –3.
4. One of the outstanding features of the chemistry of boron is its ability to form molecular addition compounds.
5. Boron does not form ionic compounds with sulphate, nitrate or other anions because boron does not form a stable cation.
6. Boron, forms acidic oxide (B_2O_3) while aluminium forms amphoteric oxides and other members forms basic oxides.

2. How will you prepare borax from: (a) Colemanite (b) Boric Aid (Sgr 10, Grw 12)

Ans. Preparation of borax from

(a) Colemanite

Now-a-days borax is almost exclusively obtained from calcium borate. Finely powered colemanite is boiled with Na_2CO_3 solution, when $CaCO_3$ precipitates out and a mixture of borax and sodium metaborate is formed.

$$\underset{\text{Colemanite}}{Ca_2B_6O_{11}} + 2Na_2CO_3 \longrightarrow 2CaCO_3 + Na_2B_4O_7 + 2NaBO_2$$

The clear solution from the top is taken off and is then allowed to crystallize, when crystals of borax separate out. To get more borax, CO_2 is blown through the mother-liquor, the sodium metaborate is decomposed into borax, which separates out in the form of fine crystals.

$$\underset{\text{Sodium metaborate}}{4NaBO_2} + CO_2 \longrightarrow Na_2CO_3 + \underset{\text{Borax}}{Na_2B_4O_7}$$

(b) Boric Acid

Formally borax was manufactured by treating a hot solution of boric acid with the proper amount of soda ash.

$$\underset{\text{Boric acid}}{4H_3BO_3} + Na_2CO_3 \longrightarrow \underset{\text{Borax}}{Na_2B_4O_7} + 6H_2O + CO_2$$

3. Justify that the aqueous solution of borax turns red litmus blue. (D.G. Khan 09)

Ans. Aqueous Solution of Borax

Aqueous solution of borax is alkaline in nature due to hydrolysis.

$$Na_2B_4O_7 + 7H_2O \longrightarrow \underset{\text{Strong base}}{2NaOH} + \underset{\text{Weak acid}}{4H_3BO_3}$$

Aqueous solution of borax turns red litmus to blue due to the presence of alkali.

- Borax when dissolved in water ionizes as:

$$Na_2B_4O_7 \longrightarrow 2Na^+ + B_4O_7^{-2}$$

- Hydrolysis of $B_4O_7^{-2}$ ions occurs as follow:

$$B_4O_7^{-2} + 7H_2O \longrightarrow 4H_3BO_3 + 2OH^-$$

So a strong alkali (NaOH) is formed which is highly ionized. Aqueous solution of borax turns red litmus blue due to presence of alkali.

4. How H_3BO_3 can be prepared from borax? (D.G. Khan 08)

Ans. Preparation of H_3BO_3 from Borax

Aqueous solution of borax reacts with HCl or H_2SO_4 to form boric acid.

$$\underset{\text{Borax}}{Na_2B_4O_7} + 2HCl + 5H_2O \longrightarrow 2NaCl + \underset{\text{Boric acid}}{4H_3BO_3}$$

$$\underset{\text{Borax}}{Na_2B_4O_7} + H_2SO_4 + 5H_2O \longrightarrow Na_2SO_4 + \underset{\text{Boric acid}}{4H_3BO_3}$$

5. Give equations when borax is heated with NH_4Cl and CoO. (Lhr 08, Rwp 08)

Ans. Reactions of Borax with

a) NH_4Cl

When borax is heated with ammonium chloride, boron nitride is produced.

$$Na_2B_4O_7 + 2NH_4Cl \longrightarrow 2NaCl + 2BN + B_2O_3 + 4H_2O$$

BN is inorganic graphite having hexagonal structure.

b) CoO

When borax is heated it loses water of crystallization. It swells up into a white porous mass due to expulsion of water.

$$Na_2B_4O_7 \cdot 10H_2O \xrightarrow{\Delta} Na_2B_4O_7 + 10\,H_2O$$

Sod. tetraborate

When sodium tetraborate is fused, it decomposes into sod. Metaborate and boric anhydride.

$$Na_2B_4O_7 \longrightarrow 2NaBO_2 + B_2O_3$$

(Boric anhydride)

The cobalt oxide combines with B_2O_3 to give blue coloured cobalt meta borate, both in oxidizing and reducing flame.

$$CoO + B_2O_3 \longrightarrow Co(BO_2)_2$$

(Cobalt metaborate)

6. How does borax serves as a water softening agent? (Rwp 09)

Ans. Borax as water softening agent

The hardness of water is due to the presence of soluble salt of calcium and magnesium. When borax is treated with hard water, it can remove Ca^{+2} and Mg^{+2} ions from water as insoluble calcium tetraborate and magnesium tetraborate respectively.

$$Ca^{+2} + Na_2B_4O_7 \longrightarrow CaB_4O_7 + 2Na^{+}$$
$$Mg^{+2} + Na_2B_4O_7 \longrightarrow MgB_4O_7 + 2Na^{+}$$

7. Write Chemistry of Borax bead test giving one example. (Grw 08)

Ans. Chemistry of Borax bead Test

Objective: This test is used as confirmatory test for coloured ions of the salt, i.e. Cu^{+2}, Fe^{+2}, Mn^{+2}, Co^{+2}, Cr^{+3}, Fe^{+3} and Ni^{+2}.

Procedure: Prepare a loop at the end of a platinum wire. Heat the wire and take a little powdered borax on the hot loop. Heat again, borax first swells up and then melts into colourless, glass-like beads on the loop.

$$Na_2B_4O_7 \cdot 10H_2O \xrightarrow[10H_2O]{\Delta} Na_2B_4O_7$$

Anhydrous Borax (Swollen porous mass)

$$Na_2B_4O_7 \xrightarrow{\Delta} 2NaBO_2 + B_2O_3$$

Sod. metaborate boric anhydride

Now put a few grains of the substance, under examination, on the beads and re-heat it first in the oxidizing flame and then in the reducing flame.

Example

The metallic oxide formed from the substance, under examination, combines with B_2O_3 giving the coloured metallic borates. With cupric oxide, the beads are coloured blue in the oxidizing flame because cupric metal borates are blue in colour. $CuO + B_2O_3 \longrightarrow Cu(BO_2)_2$

7. Borate Glazes are better then silicate glazes. Explain (Lhr 12)

Ans. Borate glazes are better than silicate because they are more fusible than silicate glazes and possess a higher coefficient of expansion.

8. How the glassy mass is produced from borax? (Sgr 09, Lhr 08)

Ans. Glassy Mass from Borax

When borax is heated, it losses water and swells up into a white porous mass due to the expulsion of water. On further heating it melts into a clear transparent glass, which dissolves many metallic oxides forming coloured beads. This reaction forms the basis of borax bead test.

$$Na_2B_4O_7 \cdot 10H_2O \longrightarrow Na_2B_4O_7 + 2NaBO_2 + B_2O_3$$

Glassy mass

9. Write down uses of borax. (Lhr 12, Mtn 12, Sgr 10)

Ans. Uses of Borax

i) It is used to prepare borate glass, which is heat resistant.
ii) It is used in softening of water.
iii) It is employed in borax bead test, for the detection of metallic cations.
iv) It is used in metallurgical operations.
v) It is used as a flux in welding and metallurgy.
vi) It is employed in making washing powders.
vii) It is used in leather industry for tanning and dyeing.
viii) It is used in cosmetics, soaps, textiles, paints, medicine, match industry and as a preservative.

10. Give names and formulas of oxyacids of boron. "OR" write different names of boric acids. (D.G Khan 08, Grw 11, Fsd 10, 12)

Ans. Oxyacids of Boron

There are four important boric acids. Out of these ortho-boric acid is the most important and the stable one.

i) Orthoboric Acid, H_3BO_3 ii) Metaboric Acid, HBO_2
iii) Tetraboric Acid, $H_2B_4O_7$ iv) Pyroboric Acid, $H_6B_4O_5$

11. How does orthoboric acid react with:- a) Sodium Hydroxide (b) Ethyl Alcohol (Grw 12)

Ans. Reactions of Ortho boric acid with

a) **Sodium Hydroxide**

Boric acid is partially neutralized by caustic soda to give borax.

$$4H_3BO_3 + 2NaOH \longrightarrow Na_2B_4O_7 + 7H_2O$$

b) **Ethyl Alcohol**

Boric acid reacts with ethyl alcohol forming ethyl borate.

$$H_3BO_3 + 3C_2H_5OH \longrightarrow (C_2H_5)_3BO_3 + 3H_2O$$

Boric acid Ethyl borate

12. Show that H_3BO_3 is monobasic acid. "OR" How boric acid ionize in water? What is its basicity? (Fsd Sup 10, Lhr 11)

Ans. Ionization of Boric Acid in Water

Boric acid (H_3BO_3) is a very weak acid. It ionizes in water to a very limited extent mainly as a monobasic acid.

$$H_3BO_3 + H_2O \longrightarrow [B(OH)_4]^{-} + H^{+}$$

13. Write down two uses of boric acid (Rwp 10)

Ans. Uses of Boric Acid

i) Boric acid is used in medicines as an antiseptic, e.g. dusting powder, boric ointment and boric solution is used as an eye-wash.
ii) It is used in pottery as a glaze because borate glazes are more fusible than silicate glazes and posses a higher coefficient of expansion.

14. Why Aluminium is not found free in nature? (Fsd 08)

Ans. Free existence of aluminium

Aluminium belongs to IIA group and it is a highly reactive metal. Due to high reactivity it is not found free in nature. It is mostly found in the form of alumino – silicates and also as oxides.

15. How alumunium metal is used to remove air bubbles from molten metals? (Grw 09)

Ans. Aluminium – to remove air bubbles

If the aluminium powder is heated to 800°C and above, the metal will react with air to form aluminium oxide, Al_2O_3, and aluminium nitride, AlN. The reaction is accompanied by the evolution of heat and intense white light.

$$4Al + 3O_2 \longrightarrow 2Al_2O_3$$
$$2Al + N_2 \longrightarrow 2AlN$$

bnattAC

Because of its ability to combine with both oxygen and nitrogen, the metal is often used to remove air bubbles from molten metals.

16. How aluminium finds it uses in metallurgy and photoflash bulbs? (Lhr 11)

Ans. Aluminium – use in metallurgy and photoflash bulbs

If aluminium powder is heated to 800°C and above, the metal will react with air to form aluminium oxide. Al_2O_3, and aluminium nitride AlN. The reaction is accompanied by the evolution of heat and intense white light.

$$4Al + 3O_2 \longrightarrow 2Al_2O_3$$
$$2Al + N_2 \longrightarrow 2AlN$$

- Since the reaction is highly exothermic so used in thermite process in metallurgy.
- This property of aluminium is made use of in photoflash bulbs.

17. Give reactions of aluminium with dilute and concentrated H_2SO_4. (Fsd 12)

Ans. Reactions of Aluminium with

- **Dilute sulphuric acid**
  Aluminium does not react with dilute sulphuric acid.
- **Dilute sulphuric Acid**
  It is oxidized by hot concentrated sulphuric acid to liberate sulphur dioxide gas.

$$2Al_{(s)} + 6H_2SO_{4(aq)} \longrightarrow Al_2(SO_4)_{3(aq)} + 3SO_{2(g)} + 6H_2O_{(l)}$$

18. Write chemical formula of talc and Asbestos. (Grw 11)

Ans. Chemical Formulas of

- **Talc:**
  Talc is also called soapstone. Its chemical formula is $H_2Mg_3(SiO_3)_4$.
- **Absestos:**
  The Chemical formula of asbestos is $CaMg_3(SiO_3)_4$ or $CaSiO_3.3MgSiO_3$.

18. How carbon behaves differently from other members of its own group? (Lhr 10)

Ans. Peculiar behavior of Carbon

Carbon differs from the remaining members of Group IV-A in the following respects:

1. Metallic Characters:

Carbon and silicon are non-metals while the other members of the family are metalloids or metals.

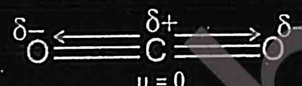
2. Catenation or self-linkage:

Carbon has a tendency to form long chains of identical atoms. The type of linkage of identical atoms with each other is called catenation or self-linkage. The property of catenation decreases on moving down the group from carbon to lead. The maximum tendency of catenation associated with carbon forms the basis of the carbon compounds which constitute organic chemistry.

19. CO_2 is non-polar while CO is polar in nature. Explain. (Lhr 10, Grw 11)

Ans. CO_2 – Non polar

CO_2 has a linear structure

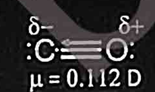


$\mu = 0$

In CO_2 the central carbon atom is sp hybridized and there is no lone pair of electrons on it. The individual dipoles being same in magnitude (0.87 D) but opposite in direction cancel the effect of each other's, therefore, dipole moment of CO_2 is zero.

CO as polar

The structure of CO is given as



$\mu = 0.112$ D

In CO, there is a lone pair of electrons on carbon. The dipole moment of CO is not zero due to high electronegative difference between carbon and oxygen. Hence, CO is polar.

20. CO_2 is Non-Polar and acidic. Give comments. (Fsd 08, D.G. Khan 10)

Ans. Non Polar nature of CO_2

CO_2 has a linear structure



$\mu = 0$

In CO_2, the central carbon atom is sp hybridized and there is no lone pair of electrons on it. The individual dipoles being same in magnitude but opposite in direction cancel the effect of each other's, therefore, dipole moment of CO_2 is zero.

Acidic Character of CO_2

CO_2 is a non-metal oxide. When it is dissolved in water, carbonic acid is formed.

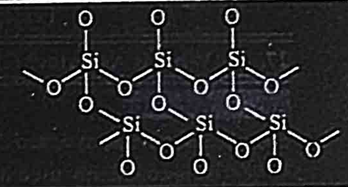
$$CO_2 + H_2O \rightleftharpoons H_2CO_3$$

Due to H_2CO_3 formation, it is acidic in nature.

21. Write a structural formula showing silicon dioxide a covalent – network solid. What is its formula unit? (Fsd 09)

Ans. Structure of Silica

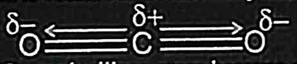
In the interior of the silica network every silicon atom is bounded tetrahedral to four oxygen atoms and every oxygen atom is bounded to two silicon atoms. The overall ratio of silicon to oxygen atoms is 1:2 and the simplest formula for silica therefore is SiO_2. The silicon oxygen bonds are strong and keep the atoms firmly in place.



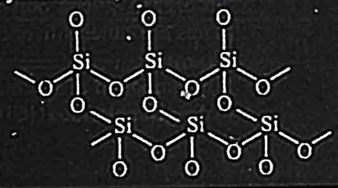
22. Why CO_2 is a gas while SiO_2 is a solid at room temperature? (D.G.Khan 08, Rwp 08, Sgr 10, Lhr 12)

Ans. CO_2 a gas and SiO_2 a solid at room temperature

CO_2 molecule has a monomeric linear structure while SiO_2 has an infinite three dimensional polymeric tetrahedral structure. The reason is that size of carbon atom is smaller than the size of silicon atom. So, in CO_2 each carbon atom forms two double bonds with two oxygen atoms. In this way a small, symmetrical, linear molecule of CO_2 is formed, which is volatile and reasonably reactive.



In case of SiO_2, each silicon atom because of its large size is covalently bonded with four oxygen atoms and each oxygen atom is attached with two silicon atoms. In this way a three dimensional network is formed. So giant structure of SiO_2 is very stable. Thus SiO_2 exists as solid.



23. What is vitreous silica? Give its two uses. (Grw 12)

Ans. Vitreous Silica

When crystalline silica is heated sufficiently (1600°C) it melts to give a viscous liquid having a random structure, presumably with the silicon atoms still on the average close to four oxygen atoms and the oxygen atoms close to two silicon atoms. When this liquid silica is cooled it does not crystallize readily, but usually it undercools tremendously and eventually becomes rigid without having undergone orientation into a regular crystal pattern. This rigid, highly undercooled liquid is called vitreous silica or silica glass.

- **Uses**
  Vitreous silica has very low thermal expansion due to which it is not easily fractured by changing temperature.

24. What are silicates? Give one example. (Grw 09, Fsd 08)

Ans. Silicates

"The compounds derived from silicic acid (H_2SiO_3) are termed as silicates."

Example:

Sodium silicate (Na_2SiO_3) is a sodium salt of metasilicic acid H_2SiO_3. It is known as water glass or soluble glass.

bhatti Academy

25. What is chemical Garden? (Fsd Sup10, Grw 09, Sgr 09, Fsd 12)

Ans. Chemical Garden

When crystals of soluble coloured salt like nickel chloride ($NiCl_2$), ferrous sulphate ($FeSO_4$), copper sulphate ($CuSO_4$) or cobalt nitrate ($Co(NO_3)_2$) etc. are placed in a solution of sodium silicate, they produce a very beautiful growth, like plant, which is called chemical garden.

26. How weathering phenomena convert potassium feld spar into clay? (Lhr 10)

Ans. Weathering of potassium Feld Spar

Alumimium silicates are formed by the chemical weathering of the rocks. Clay is an example of aluminium silicate.

The melting and freezing of water in the feldspar and chemical action of water and carbon dioxide, convert these compounds into potassium carbonate, sand and clay. The following reaction explains the weathering of potassium feldspar.

$$K_2O.Al_2O_3.6SiO_2 + H_2CO_3 + H_2O \longrightarrow K_2CO_3 + 4SiO_2 + Al_2O_3.(SiO_3)_2.2H_2O$$

Feldspar — Clay

27. What is Asbestos? Give its uses.

Ans. Asbestos

Asbestos is hydrated calcium magnesium silicate $CaMg_3(SiO_3)_4$ or $CaSiO_3.3MgSiO_3$.

It is commonly used in making.

- Incombustible fabrics
- Hardboard etc.

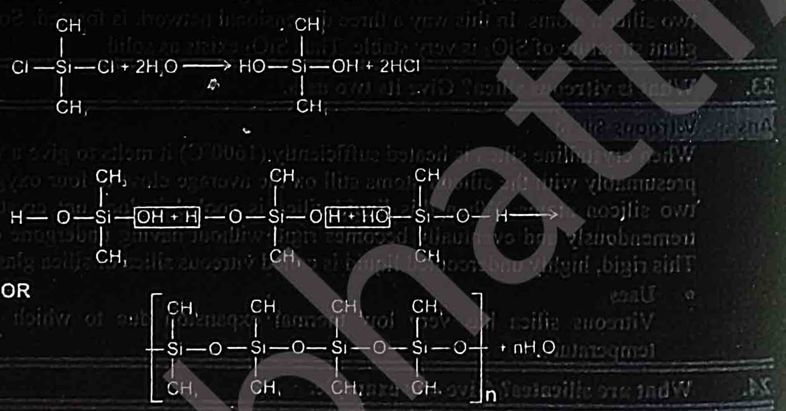
28. What are silicones? Give one example. (Rwp 09, Lhr 09, Rwp 08)

Ans. Silicones

"In organo silicon polymer in which Si – O – Si chain is present having alkyl or aryl groups attached to the Si-atoms are called silicones."

Example:

If a compound of silicon containing chlorine atoms and methyl groups $SiCl_2(CH_3)_2$, is allowed to react with water, hydrogen chloride (HCl) comes out, and the silicon atoms join together through oxygen atoms.



Methyl Silicone

29. Write two applications of silicones. (Fsd 10)

Ans. Applications of Silicones

(1) As Lubricants

Some methyl silicones are oily liquids and they become as more viscous as the chain length increases. They are used as lubricants either incorporated in greases or as oils, in bearings, gears, etc. they are also used in hydraulic brakes and other hydraulic systems.

(2) As Water repellants

Another interesting and important application of silicones is their use in the treatment of various surfaces to make them water repellent. A silicone film covers the surface and repels water like a grease film. Much of the leak of electricity through moisture film on ceramic electrical insulators can be prevented by a silicon film; cloth, plastics, asbestos, glass, leather, and paper, even filter paper and blotting paper become strongly water repellent when covered with silicone film.

30. Why are liquid silicones preferred over ordinary organic lubricants? (Sgr 09, Grw 08, Rwp 09)

Ans. Liquid silicones preferred over ordinary organic lubricants

- **Small change in viscosity with temperature:** The outstanding physical attribute of silicone oil is its very small change in viscosity with change in temperature, compared with the behavior of other oils of similar viscosity.
  If the temperature is dropped from 100°C to 0°C, the viscosity of petroleum oil may increase about one hundred folds, whereas that of silicones oil will increase less than four folds.
- **Resistant towards oxidation:** In the presence of air or oxygen at temperature as high as 300°C, silicone oils remain free from acid formation, oxidation and similar phenomena, which frequently limit the usefulness of petroleum products and other synthetic organic liquids.

31. Define Semiconductor. Give one example (Fsd Sup 10, Grw 10)

Ans. Semiconductor

"A substance that has different resistances to the passage of an electric current under different circumstances is called a semi-conductor."

Example: Silicon is a semi-conductor.

32. How a Semi-conductor is different from a conductor? (Fsd Sup10)

Ans. Difference between conductor and Semi-Conductor

- A semi-conductor conducts electricity better than an insulator but not as well as good conductors like metals. So they are also called half-conductors.
- The electrons in semi-conductors do not carry electric current as readily as the electrons of metals which are good conductors.
- When the atoms of semi-conductor absorbs heat or light, the electrons become less tightly bound to their atoms and conductivity increases while of metals decreases.

33. Write balanced chemical equations to show decompositions of:
(a) Lead oxalate (b) Red Lead (Fsd 09)

Ans. Decompositions of

a) Lead Oxalate:-

Plumbous oxalate (lead oxalate) decomposes on heating in the absence of air to lead suboxide Pb_2O

$$2PbC_2O_4 \xrightarrow{\Delta} Pb_2O + 3CO_2 + CO$$

b) Red Lead

$$2Pb_3O_4 \xrightarrow{470°C} 6PbO + O_2$$

34. What is Litharge? Give its chemistry. (Lhr 11)

Ans. Litharge

Litharge is lead monoxide. It varies in colour from pale yellow to reddish yellow, possibly owing to the existence of two forms, a rhombic (yellow) and a tetragonal (red). It is slightly soluble in water.

bhatti Academy

35. Give uses of lead suboxide. (Lhr 11)

Ans. **Uses of lead suboxide**

Lead suboxide is used

- As pigment
- In the manufacture of lead storage batteries.

36. Give the formula of white lead. Also give its one use. (D.G. Khan 09)

Ans. **White lead**

White lead $2PbCO_3 - Pb(OH)_2$, is a an amorphous white pigment. It mixes readily with linseed oil and has a god covering power. If improperly prepared, it becomes crystalline and its covering power is reduced.

CHAPTER 4

Group VA And Group VIA Elements

Solved Objective Exercise

Q1. Fill in the blanks.

(i) The elements _____ of group VA are called metalloids
(ii) In Birkeland and Eyde's process _____ is prepared from atmospheric oxygen and nitrogen.
(iii) The tendency to form long chain of atoms is called _____.
(iv) All the elements of group VIA show the property of _____.
(v) Selenium shows two allotropic forms which are called _____ forms.
(vi) Specific gravity of H_2SO_4 at 18°C is _____.
(vii) H_2 is produced by reacting H_2SO_4 with metals, like _____.
(viii) The elements of group VA exhibit maximum oxidation state of _____.
(ix) The outermost shell of group _____ elements contain six electrons.
(x) Oxygen shows _____ behaviour due to the presence of unpaired electrons.
(xi) Conc. Phosphoric acid acts as a _____.
(xii) Nitrogen is gas while other elements of the same group are _____.
(xiii) Noble metals like gold and platinum are dissolved in _____.
(xiv) Sulphur is different from oxygen because it shows _____ oxidation states.
(xv) HNO_3 is used in the manufacture of _____fertilizers.

Answer Key

(i)	Arsenic & Antimony	(ii)	(NO) nitric oxide	(iii)	Catenation
(iv)	Allotropy	(v)	Red and grey	(vi)	1.834
(vii)	Fe, Mg, Zn, Sn	(viii)	+5	(ix)	VI-A
(x)	Paramagnetic	(xi)	Deliquescent	(xii)	Solid
(xiii)	Aqua Regia	(xiv)	Variable	(xv)	Nitrogeneous

Q2. Indicate True or False.

(i) The metallic character in groups VA and VIA elements increases down the group.
(ii) The elements of group VA exhibit maximum oxidation state of + 5.
(iii) Ionization energy of phoshorus is greater than that of nitrogen.
(iv) The electronegativity of oxygen is greater than all other elements of groups VA and VIA.
(v) V_2O_5 is used as a catalyst for the oxidation of SO_2 to SO_3.
(vi) The oxides of nitrogen are basic in nature.
(vii) Aqua regia is prepared by mixing 3 parts of conc. HNO_3 with one part of conc. HCl.
(viii) TNT is prepared by the reaction of nitric acid with toluene.
(ix) P_2O_3 when reacts with cold water gives phosphorus acid and with hot water it gives phosphoric acid.
(x) Sulphur occurs in many organic compounds of animal and vegetable origins.

bhattiAcademy

(i)	True	(ii)	True	(iii)	False	(iv)	True	(v)	True
(vi)	False	(vii)	False	(viii)	True	(ix)	True	(x)	True

Q3. Multiple choice questions. Encircle the correct answer.

(i) Out of all the elements of group VA, the highest ionization energy is possessed by.
(a) N (b) P (c) Sb (d) Bi

(ii) Among group VA elements, the most electronegative elements is
(a) Sb (b) N (c) P (d) As

(iii) Oxidation of NO in air produces
(a) N_2O (b) N_2O_3 (c) N_2O_4 (d) N_2O_5

(iv) The brown gas formed, when metal reduces HNO_3 to
(a) N_2O_5 (b) N_2O_3 (c) NO_2 (d) NO

(v) Laughing gas is chemically
(a) NO (b) N_2O (c) NO_2 (d) N_2O_4

(vi) Out of all the elements of group VIA, the highest melting and boiling points is shown by the element.
(a) Te (b) Se (c) S (d) Pb

(vii) SO_3 is not absorbed in water directly to form H_2SO_4 because
(a) The reaction does not go to completion (b) The reaction is quite slow.
(c) The reaction is highly exothermic (d) SO_3 is insoluble in water.

(viii) Which catalyst is used in contact process?
(a) Fe_2O_3 (b) V_2O_5 (c) SO_3 (d) Ag_2O

(ix) Which of the following specie has the maximum number of unpaired electrons?
(a) O_2 (b) O_2^{-1} (c) O_2^{+1} (d) O_2^{2-}

Solved Exercise MCQ's

Q. No	Answer	Reason
(i)	(a) N	Size of N is smallest than other elements of its group. Due to small size, it is very difficult to remove an electron from its outermost shell, that's why it has highest ionization energy.
(ii)	(b) N	Electrongativity decreases down the group.
(iii)	(c) N_2O_4	$2NO + O_2 \longrightarrow 2NO_2$ $\Rightarrow NO_2$ gas exists in N_2O_4 state (dimer)
(iv)	(c) NO_2	$Cu_{(s)} + 4HNO_{3(conc.)} \longrightarrow Cu(NO_3)_{(conc.)} + 2NO_{2(g)} + 2H_2O_{(l)}$ $\Rightarrow NO_2$ gas is reddish brown in color.
(v)	(b) N_2O	Its mixture with little oxygen, if inhaled for sufficiently long time causes hysterical laughter.
(vi)	(a) Te	The melting and boiling point increases down the group among non-metals. So, Te has highest melting (450^oC) and boiling point (990^oC).
(vii)	(c) The reaction is highly exothermic	The reaction of SO_3 and water is highly exothermic as heat contents of reactants is higher than that of product (H_2SO_4)
(viii)	(b) V_2O_5	V_2O_5 is very effective catalyst for the conversion of SO_2 to SO_3 gas.
(ix)	(a) O_2	No. of unpaired electrons in O_2 = 2 No. of unpaired electrons in O_2^- = 1 No. of unpaired electrons in O_2^{+} = 1 No. of unpaired electrons in O_2^{+2} = 0

Previous Boards MCQ's

1. Which of the following statement is incorrect (D.G Khan 08)
(a) H_2SO_4 acts as a strong oxidizing agent (b) H_2SO_4 acts as a strong reducing agent
(c) H_2SO_4 acts as a dehydrating agent (d) H_2SO_4 acts as a sulphonating agent

2. Bone ash contains (D.G Khan 09)
(a) 80 % P (b) 80 % $Ca_3(PO_4)_2$ (c) 90 % P (d) 90 % $Ca_3(PO_4)_2$

3. Catalyst used in contact process is (D.G Khan 10, Grw 09, 12)
(a) Fe_2O_3 (b) V_2O_5 (c) NO (d) Ag_2O

4. Laughing gas is (Rwp 08, Sgr 09, Grw 12)
(a) NO (b) NO_2 (c) N_2O (d) N_2O_5

5. Sulphur is an essential constituent of (Rwp 09)
(a) Chlorophyll (b) Plant (c) Protein (d) All of these

6. Nitric acid can be transported in a container made up of (Rwp 09)
(a) Al (b) Zn (c) Cu (d) none of these

7. Which of the followings gas is evolved when copper reacts with dil. HNO_3? (Rwp 09)
(a) N_2O (b) NO (c) NO_2 (d) none of these

8. The geometrical shape of PCl_5 is (Rwp 09)
(a) octahedral (b) square planer (c) trigonal bipyramidal (d) tetrahedral

9. The most electronegative element in group VA is (Fsd 09, Lhr 12, Rwp 10)
(a) Sb (b) N (c) He (d) SO_2

10. S, Se, Te and Po are called (Fsd 08)
(a) coinage metals (b) alkali metals (c) halogens (d) chalcogens

11. Gold dissolves in aqua regia to form (Fsd 10)
(a) $AuCl_3$ (b) NaH_2BO_3 (c) $Na_2B_4O_7$ (d) Na_3BO_3

12. In phosphorous one of the 3p electrons can be promoted to a vacant 3d orbitals giving (Fsd Sup 10)
(a) 2 unpaired electrons in the valence shell (b) 3 unpaired electrons in the valence shell
(c) 4 unpaired electrons in the valence shell (d) 5 unpaired electrons in the valence shell

13. Arsenic oxides are removed during manufacture of H_2SO_4 by passing through (Sgr 10)
(a) ferric hydroxide (b) sodium hydroxide
(c) calcium hydroxide (d) potassium hydroxide

14. SO_3 is not absorbed in water directly to form H_2SO_4 because (Grw 08)
(a) the reaction does not go to completion (b) the reaction is quite slow
(c) the reaction is highly exothermic (d) SO_3 is insoluble in water

15. The highest ionization energy is possessed by (Grw 11)
(a) nitrogen (b) phosphorous (c) bismuth (d) antimony

16. Which of the following is not property of phosphorus (Lhr 08)
(a) it means light bearing (b) it does not exist free in nature
(c) Rich source of phosphorus is bone ash (d) it does not exist in allotropic forms

17. Molecular formula of white phosphorus is (Lhr 09)
(a) P_4 (b) P_8 (c) P_6 (d) P_2

18. At 18°C the specific gravity of H_2SO_4 is (Lhr 10)
(a) 1.891 (b) 1.834 (c) 2.101 (d) 1.740

19. The element whose inorganic minerals are not much abundant in earth crust (Lhr 11)
(a) Li (b) N (c) Na (d) O

20. Oxidation of NO in air produces: (Fsd. 12)
(a) N_2O (b) N_2O_3 (c) N_2O_5 (d) N_2O_4

21. Ortho phosphoric acid has melting point: (Lhr. 12)
(a) 49°C (b) 45°C (c) 41°C (d) 50°C

Entry Test MCQ's

1. Which oxidation state is not shown by phosphorus
(a) -3 (b) +5 (c) +3 (d) -2

2. Which of the following oxide is acidic as well as solid at room temperature
(a) SiO_2 (b) PbO_2 (c) CO_2 (d) SnO_2

3. What is the general electronic configuration of Group IVA elements
(a) ns^2np^4 (b) ns^2np^6 (c) ns^2np^2 (d) ns^2

4. Fire extinguishers contains a bottle of H_2SO_4 and:
(a) $CaCO_3$ (b) $NaHCO_3$ (c) $MgCO_3$ (d) Any carbonate

5. Phosgene is the common name given to:
(a) Carbonyl chloride (b) Phosphine (c) Acetylene (d) Phosphorus trichloride

6. Lead pencil contains
(a) Graphite (b) Charcoal (c) Lead (d) Lead sulphite

7. Concentrated nitric acid gives----------when it reacts with tin.
(a) Nitric oxide (b) Meta stannic acid (c) Ammonium nitrite (d) Nitrous oxide

8. The oxide in which N has the highest oxidation state
(a) Nitrous oxide (b) Nitric oxide (c) Nitrogen peroxide (d) Nitrous anhydride

9. Which of the following does not give NO with dil HNO_3
(a) Cu (b) Hg (c) Zn (d) Ag

10. Which of the following is in the solid state
(a) N_2O_5 (b) N_2O (c) N_2O_4 (d) NO_2

11. Which allotropic form of phosphorous is more reactive
(a) White (b) black (c) red (d) violet

12. Which of the following is a neutral oxide?
(a) N_2O (b) N_2O_3 (c) NO_2 (d) N_2O_5

13. Aqua regia can dissolve noble metals due to the formation of
(a) nitrosyl chloride (b) nascent nitrogen (c) nitric oxide (d) nitrous acid

14. Boric acid cannot be used:
(a) As antiseptic in medicine (b) For enamels and glazes
(c) For washing eyes (d) In soda bottles

15. Nitrous oxide is prepared in the laboratory by:
(a) Combination of nitrogen and oxygen (b) Reduction of nitric acid
(c) Reduction of NO (d) Thermal decomposition of NH_4NO_3

16. Which one of the compound is not known
(a) NCl_5 (b) $AsCl_5$ (c) PCl_5 (d) NCl_3

17. Nitrogen dioxide cannot be obtained by heating:
(a) KNO_3 (b) $Ca(NO_3)_2$ (c) $Pb(NO_3)_2$ (d) $Cu(OH)_2$

18. When treated with nitric acid which of the following will liberate hydrogen
(a) Zinc (b) Magnesium (c) Copper (d) Mercury

19. The bonds present in N_2O_5 are:
(a) Only ionic (b) Covalent and coordinate covalent
(c) Only covalent (d) Covalent and ionic

20. Which of the following will combine with Fe (II) ion to from a brown complex compound
(a) N_2O (b) NO (c) N_2O_3 (d) NO_2

21. Red phosphorus is made by heating yellow phosphorus in the presence of an inert gas at temperature:
(a) 80° C (b) 240°C (c) 200°C (d) 100°C

22. Which gas is obtained when urea reacts with nitrous acid
(a) N_2 (b) NO (c) N_2O (d) NO_2

23. Which of the following properties of white phosphorus are shared by red phosphorus
(a) It phosphorescences in air (b) It dissolved in CS_2
(c) It burns when heated in air (d) It reacts with NaOH to give PH_3

24. Nitrogen molecule is chemically less active because of its:
(a) Small atomic energy (b) High dissociation energy
(c) high electronegativity (d) Stable electronic configuraion

25. PCl_3 is kept in well stoppered bottled because:
(a) It is highly volatile (b) It reacts readily with moisture
(c) It reacts with oxygen (d) It is explosive

26. Red phosphorus is less reactive than yellow phosphorus because:
(a) Its colour is red (b) It is highly polymerized
(c) It is tetratomic (d) It is hard

27. When concentrated nitric acid is heated , it decomposes to give
(a) Oxygen and nitrogen (b) Nitric oxide
(c) Oxygen (d) Nitrogen dioxide and oxygen

28. Which oxide does not act as a reducing agent
(a) NO (b) NO_2 (c) N_2O_5 (d) N_2O

29. Non-metal combine with oxygen to form usually
(a) Basic oxide (b) Neutral oxide (c) Acidic oxide (d) Amphoteric oxide

30. The most stable allotropic form of sulphur is:
(a) Rhombic (b) Monoclinic (c) Plastic (d) Milk of sulphur

31. Which one of the following pairs does not react with H_2SO_4 at all
(a) Zn, Fe (b) Sn, Mg (c) Pb, Cu (d) Au, Pt

32. The element which evolves two gases with conc. H_2SO_4 is:
(a) Si (b) C (c) S (d) P

33. Anhydride of sulphuric acid is:
(a) SO_2 (b) SO_3 (c) $H_2S_2O_3$ (d) H_2SO_3

34. Which of the following acts as pickling agent
(a) HNO_3 (b) H_2SO_4 (c) HCl (d) HNO_2

35. All the elements of the oxygen family are:
(a) non-metals (b) Metalliods (c) radioactive (d) polymorphic

36. Sulphuric acid can not be used as:
(a) Hygroscopic agent (b) Oxidizing agent (c) Sulphonating agent (d) Efflorescent

37. Which of the following has highest ionic character
(a) $PbCl_4$ (b) $PbCl_2$ (c) CCl_4 (d) $SiCl_4$

38. Graphite is not
(a) A good conductor of heat (b) Softer than diamond
(c) An amorphous of carbon (d) Used of making lubricants

39. When aluminium is heated in atmosphere of nitrogen forms a nitride of formula
(a) AlN (b) AlN_3 (c) Al_3N (d) Al_2N_3

40. Aluminium does not react with
(a) NaOH (b) N_2 (c) HCl (d) HNO_3

bhattiAcademy

Additional MCQ's

1- Nitrous acid is prepared by the reaction of water with:
(a) NO_2 (b) NO (c) N_2O_3 (d) N_2O_5

2- The decomposition of nitrous acid gives:
(a) Nitrous oxide (b) Nitrous anhydride (c) Nitric oxide (d) Nitric anhydride

3- Nitrous acid is oxidized to give:
(a) Dinitrogen oxide (b) Dinitrogen trioxide (c) Nitric oxide (d) nitric acid

4- Nitrous acid when reacts with organic compound gives:
(a) Oxygen (b) Nitrogen (c) Hydrogen (d) none

5- Nitrous Acid reacts with aniline to give:
(a) Benzene (b) Urea (c) Sodium Hydroxide (d) Phenol

6- Nitric acid is synthesized on small scale from
(a) HNO_2 (b) KNO_3 (c) $KHSO_4$ (d) NO_2

7- Nitric acid is manufactured by:
(a) Contact process (b) Lead chamber (c) Birkeland and Eyde's process (d) Fermentation

8- At 15 °C the specific gravity of HNO_3 is:
(a) 1.84 (b) 1.35 (c) 1.53 (d) 1.24

9- When nitric Acid reacts with carbonates it release:
(a) O_2 (b) N_2 (c) H_2 (d) CO_2

10- Gold reacts with nirtric acid to give:
(a) Oxide (b) Hydroxide (c) Hydrogen (d) None

11- With concenterated HNO_3 copper gives:
(a) NO (b) NO_2 (c) N_2O_3 (d) N_2O

12- Concenterated HNO_3 with mercury gives:
(a) Mercurous nitrate (b) Mercuric nitrate (c) NO (d) None

13- Nitroglycerine is used as:
(a) Laboratory reagent (b) fertilizer (c) Explosives (d) Dyes

14- Those Metals which react with cold dilute H_2SO_4 and librate Hydrogen are:
(a) Fe, Zn, Cu (b) Sn, Mg, Fe (c) Zn, Mg, Hg (d) Fe, Sn, Ag

15- Te has two allotropic forms:
(a) Metalic and Non metalic (b) Red and grey (c) Flint and quartz (d) a & b

16- H_2SO_4 reacts with SO_3 to form:
(a) Vitriol (b) Oleum (c) $H_2S_2O_6$ (d) SO_2

17- H_2SO_4 acts as:
(a) Oxidizing agent (b) Reducing agent (c) Dehydrating agent (d) Both a & c

18- In contact procees which of the following is used as arsenic Purifier:
(a) $Fe(OH)_2$ (b) $Fe(OH)_3$ (c) $FeSO_4$ (d) $Fe_2(SO_4)_3$

19- ..... is used in storage cells and electrical battery:
(a) H_2SO_4 (b) Oleum (c) H_3PO_4 (d) HPO_3

20- Which gas is more heavier than air:
(a) N_2O (b) NO (c) NO_2 (d) Cl_2

21- NO form a ..... with $FeSO_4$ (Ring test is performed)
(a) Substitution product (b) Oxidizing product (c) Addition product (d) Reducing Product

22- P_2O_5 acts as:
(a) Oxidising agent (b) Dehydrating agent (c) Reducing agent (d) None of these

23- H_3PO_3 act as:
(a) Reducing agent (b) Oxidizing agent (c) Dehydrating agent (d) None of these

24- The oxidation state of S in S_2Cl_2 is:
(a) +1 (b) +2 (c) +3 (d) +4

25- Pyrophosphoric acid is:
(a) HPO_3 (b) $H_2P_2O_7$ (c) $H_4P_2O_7$ (d) H_3PO_4

26- TNT is prepared by the action of nitric acid on:
(a) Benzene (b) Toluene (c) Phenol (d) None of these

27- Formula of Pyrosulphuric acid is:
(a) HSO_4^{-1} (b) H_2SO_4 (c) $H_2S_2O_6$ (d) $H_2S_2O_7$

28. Sulphuric acid is a dibasic acid because:
(a) it gives two OH^- ion
(b) Each molecule produces two H^+ ions
(c) H_2SO_4 is acid as well as dehydrating agent (two properties)
(d) None of these

29. Sulphuric acid acts as dehydrating agent in reaction with:
(a) Formic acid (b) Zinc (c) Copper (d) Sodium hydroxide

30. Which one of the following molecules is paramagnetic in nature?
(a) N_2 (b) He (c) H_2 (d) O_2

31. Oxygen differs from the other elements of group-VIA beacuse:
(a) It exists as diatiomic state (b) Its oxidation state is -2
(c) Its outermost shell can accept two electrons (d) None of these

32. Nitrogen differs from the other elements of group-VA in which of following properties:
(a) Its outermost shell has five electrons in it (b) It is a gas at room temperature
(c) It forms covalent bond (d) All

33. All pathogenic micro – organisms are killed by:
(a) CO (b) Cl_2 (c) H_2S (d) HCl

34. Physical appearance of bismuth is:
(a) Non-metallic solid (b) Colourless liquid (c) Metallic solid (d) Grey solid

35. Nitrogen is chemically inert to all atoms at room temperature except:
(a) Mg (b) Ca (c) Li (d) Na

36. Which form of phosphorus is most stable:
(a) White (b) Red (c) Black (d) All are equally stable

37. The hardest of the following solids is :
(a) Na (b) SiO_2 (c) Graphite (d) Mg

38. The gas which cannot be dried by conc. H_2SO_4
(a) SO_2 (b) NH_3 (c) NO_2 (d) HCl

39. Which of the following acids possess oxidizing and reducing properties :
(a) HCl (b) HNO_2 (c) HNO_3 (d) H_2SO_4

40. The chemical composition of Cinnabar is:
(a) ZnS (b) PbS (c) HgS (d) FeS

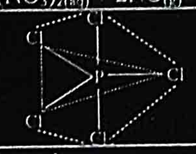
41. Wheih one of the following is pale yellow?
(a) NO (b) N_2O (c) NO_2 (d) N_2O_4

42. Glucose and cane sugar becomes black when conc. H_2SO_4 is added to it. The function of H_2SO_4 is:
(a) Oxidizing agent (b) Reducing agent (c) Dehydrating agent (d) Carbonating agent

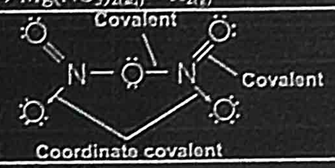
bhatti Academy

ANSWERS TO MCQ'S

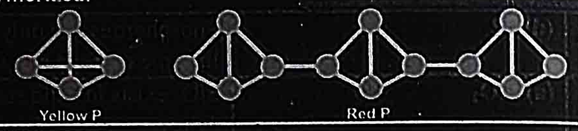
Previous Boards MCQ's

Q. No	Answer	Reason
1.	(b) H_2SO_4 acts as a strong reducing agent.	H_2SO_4 is a strong oxidizing agent and not a reducing agent.
2.	(b) 80% $Ca_3(PO_4)_2$	Bone ash is an important source of phosphorus.
3.	(b) V_2O_5	V_2O_5 is effective catalyst used in the conversion of SO_2 to SO_3 gas.
4.	(c) N_2O	It is mixture with little oxygen, if inhaled for sufficiently long time, it causes hysterical laughter.
5.	(c) Protein	S is an essential constituent of protein and also occurs in various other components of plants. It has influence on chlorophyll development
6.	(a) Al	Nitric acid can react with Cu and Zn but the acid is said to render aluminum passive. So, it is transported in a container made up of Al.
7.	(b) NO	$3Cu_{(s)} + 8\,HNO_{3(dil.)} \longrightarrow Cu(NO_3)_{2(aq)} + 2NO_{(g)} + 4H_2O_{(l)}$
8.	(c) trigonal bipyramidal	
9.	(b) N	Electronegativity decreases down the group.
10.	(d) Chalcogens	The word "Chalcogens" is derived from greek for "Copper giver". These elements are found in copper ores.
11.	(a) $AuCl_3$	$AuCl_3$ is soluble chloride of gold due to which gold becomes dissolved in aqua regia.
12.	(c) 4 unpaired electrons in the valence shell.	The valence shell electronic configuration of phosphorous is 3s 3p 3d ↿⇂ ↿⇂ 1 1 ☐☐☐☐☐ When one of 3p electrones is promoted to valence shell then 3s 3p 3d ↿⇂ 1 1 1 1 ☐☐☐☐ The number of unpaired electrons is 4
13.	(a) ferric hydroxide	Freshly prepared ferric hydroxide removes arsenic oxide from the gases.
14.	(c) The reaction is highly exothermic.	Because heat content of reactants is more than that of product (H_2SO_4)
15.	(a) nitrogen	Due to small size of N; it is difficult to remove an electron from its outermost shell.
16.	(d) It does not exist in allotropic forms.	Phosphorous has six allotropic forms:- 1) α - Black P 2) Red P 3) β - Black P 4) white P 5) violet P 6) Scarlet P
17.	(a) P_4	White phosphorous exists in tetra atomic molecules (P_4) which have tetrahedral structure.
18.	(b) 1.834	Specific gravity of $H_2SO_4 = \frac{\text{Density of } H_2SO_4}{\text{Density of water}}$ In some cases, it is also called strength to weight ratio.
19.	(b) N	Inorganic compounds of N are not commonly found as minerals.
20.	(d) N_2O_4	$2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$ NO_2 exists in dimer form i.e. N_2O_4
21.	(c) 41°C	Orthophosphoric acid is H_3PO_4

Entry Test MCQ's

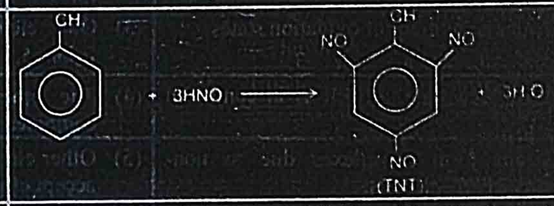
1.	(d) - 2	Phosphorous can only show oxidation states + 3 and + 5 e.g., in PCl_3 and PCl_5 In some cases, it can show -3 oxidation state but '-2' is not shown by it.
2.	(a) SiO_2	SiO_2 exists in solid state. Due to non-metallic nature oxide of silicon is acidic in nature.
3.	(a) $ns^2\,np^4$	Group VI elements have six electrons in their valence shell so valence shell electronic configuration is $ns^2\,np^4$.
4.	(d) Any carbonate	Carbonates react with H_2SO_4 to form CO_2 which helps in fire extinguisher,
5.	(a) Carbonyl chloride	$COCl_2$ (Carbonyl chloride) is called phosgene.
6.	(a) Graphite	Lead pencil contains graphite.
7.	(a) Nitric oxide	$Sn + 4HNO_{3(Conc.)} \longrightarrow H_2SnO_3 + 4NO_2 + H_2O$
8.	(c) Nitrogen Peroxide	In Nitrous oxide (N_2O), oxidation state of nitrogen is '+1". In Nitric oxide (NO), the oxidation state of nitrogen is "+2". In Nitrogen peroxide (NO_2), the oxi-state of nitrogen is "+4" and '+3' in nitric anhydride (N_2O_3)
9.	(c) Zn	Zn gives N_2O with dil. HCl.
10.	(c) N_2O_4	N_2O_4 is colourless solid.
11.	(a) White	White phosphorus is very reactive due to the angle strain. P – P bond angle in P_4 (tetrahedral) is only 60°.
12.	(a) N_2O	N_2O_3 and N_2O_5 give HNO_2 and HNO_3 with water and NO_2 is also acidic oxide but N_2O is neutral.
13.	(a) Nitrosyl chloride	When one volume of conc. HNO_3 is mixed with three volumes of conc. HCl aqua regia is formed. It gives NOCl (nitrosyl chloride) which decomposes to give Cl_2 and dissolves noble metals. $HNO_{3\,(conc)} + 3HCl_{(conc.)} \longrightarrow NOCl_{(aq)} + 2H_2O + Cl_{2(g)}$
14.	(d) In Soda Bottles	Boric acid is not used in soda bottles but CO_2 gas is used.
15.	(d) Thermal decomposition of NH_4NO_3.	$NH_4NO_3 \xrightarrow{200°C} N_2O_{(g)} + 2H_2O$
16.	(a) NCl_5	Due to absence of d-orbital, nitrogen does not show "+5" oxidation state and NCl_5 is not known.
17.	(d) $Cu(OH)_2$	Metal nitrates decompose on heating to give NO_2, while decomposition of $Cu(OH)_2$ does not give NO_2.
18.	(b) Magnesium	$Mg_{(s)} + 2HNO_{3(dil.)} \longrightarrow Mg(NO_3)_{2(aq)} + H_{2(g)}$
19.	(b) Covalent and coordinate covalent	
20.	(b) NO	$FeSO_4 + NO \longrightarrow FeSO_4.NO$ Brown ring
21.	(b) 240°C	Red phosphorus is made by heating yellow phosphorus in the presence of iodine at 240 or 250°C in vacuum.
22.	(a) N_2	$2HNO_{2(aq)} + (NH_2)_2CO_{(aq)} \longrightarrow 2N_{2(g)} + CO_{2(g)} + 3H_2O_{(l)}$
23.	(a) It phoshorescences in air	All types of P show phosphorescence in air , meaning 'light' bearing."
24.	(d) Stable electronic configuration.	Valence shell of nitrogen is half filled, which results in high stability of nitrogen due to which it is less active.
25.	(a) It is highly volatile	PCl_5 is volatile solid and sublimes at about 100°C and gives fumes in air.

Bhatti Academy

26.	(b) It is highly polymerized	Yellow phosphorus exists in individual P_4 molecules but red phosphorus is highly polymerized. 
27.	(d) Nitrogen dioxide and oxygen	$4HNO_{3(aq)} \longrightarrow 2H_2O_{(l)} + 4NO_{2(g)} + O_{2(g)}$
28.	(d) N_2O	N_2O can't act as a reducing agent as it gives nascent oxygen on decomposition. $N_2O_{(g)} \longrightarrow N_{2(g)} + [O]$
29.	(c) Acidic oxide	Non-metallic oxide is acidic because it yields acid in aqueous solution.
30.	(a) Rhombic	Rhombic sulphur is a stable form of sulphur.
31.	(c) Pb, Cu	Pb and Cu do not react with any concentration of H_2SO_4.
32.	(b) C	$C_{(s)} + 2H_2SO_{3(aq)} \longrightarrow CO_{2(g)} + 2SO_{2(g)} + 2H_2O_{(g)}$
33.	(b) SO_3	$SO_3 + H_2O \longrightarrow H_2SO_4$
34.	(b) H_2SO_4	H_2SO_4 removes impurities from mineral oil and acts as pickling agent.
35.	(a) Non-metals	In the non-metalic character increases across the period.
36.	(d) Effloresent	Effloresecence means to become powder by the lose of water. H_2SO_4 is not effloresent.
37.	(b) $PbCl_2$	Ionic character $\propto \frac{1}{\text{Polarizing Power}}$ Polarizing power of Pb^{+4} is more than that of Pb^{+2}. So $PbCl_2$ has more ionic character.
38.	(a) A Good conductor of heat	Graphite is a good conductor of electricity parallel to layers only and it is not a conductor of heat.
39.	(a) AlN	The oxidation state of Al is "+3" and of N is "-3" So formula is AlN.
40.	(d) HNO_3	HNO_3 is said to be render Al passive so it is transported in containers made of Al.

Additional MCQ's

1.	(c) N_2O_3	$N_2O_3 + H_2O \longrightarrow 2HNO_2$
2.	(c) Nitric Oxide	$3HNO_{2(aq)} \xrightarrow{\Delta} HNO_{3(aq)} + 2NO_{(g)} + H_2O_{(g)}$
3.	(d) Nitric Acid	$HNO_{2(aq)} + Br_{2(aq)} + H_2O_{(l)} \longrightarrow HNO_{3(aq)} + 2HBr_{(aq)}$
4.	(b) Nitrogen	$2HNO_2 + (NH_2)_2CO \longrightarrow 2N_2 + CO_2 + 3H_2O$
5.	(d) Phenol	$HNO_{2(aq)} + C_6H_5NH_{2(l)} \longrightarrow C_6H_5OH_{(l)} + N_{2(g)} + H_2O_{(l)}$ Aminobenzene → Phenol
6.	(b) KNO_3	$KNO_{3(s)} + H_2SO_{4(aq)} \longrightarrow KHSO_{4(aq)} + HNO_{3(aq)}$
7.	(c) Birkeland and Eyde's process	This process consists of four steps as a result of which HNO_3 is formed.
8.	(c) 1.53	Specific gravity is given by $\text{Specific Gravity} = \frac{\text{Density of } H_2SO_4 \text{ at } 15^\circ C}{\text{Density of } H_2O \text{ at } 15^\circ C}$
9.	(d) CO_2	$2HNO_{3(aq)} + Na_2CO_{3(aq)} \longrightarrow 2NaNO_{3(aq)} + H_2O_{(l)}$
10.	(d) None	Gold does not react with HNO_3.
11.	(b) NO_2	$Cu_{(s)} + 4HNO_{3(conc.)} \longrightarrow Cu(NO_3)_2 + 2NO_{2(g)} + 2H_2O_{(l)}$
12.	(b) Mercuric Nitrate	$Hg_{(l)} + 4HNO_{3(aq)} \longrightarrow Hg(NO_3)_{2(aq)} + 2NO_{2(g)} + 2H_2O$

13.	(c) Explosive	Nitroglycerin is formed by the reaction of glycerin with nitric acid.
14.	(b) Sn, Mg, Fe	$Fe + H_2SO_4 \longrightarrow FeSO_4 + H_2$ $Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$ $Sn + H_2SO_4 \longrightarrow Sn SO_4 + H_2$
15.	(a) Metalic and Non-Metalic	All group VIA elements show property of allotropy.
16.	(b) Oleum	$SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$
17.	(d) Both a and c	H_2SO_4 is a powerful oxidizing and dehydrating agent.
18.	(b) Fe $(OH)_3$	It is the main step of purifying unit to save the poisoning of catalyst (V_2O_5) from arsenic oxide.
19.	(a) H_2SO_4	H_2SO_4 is used in lead storage batteries.
20.	(d) Cl_2	Cl_2 is heavier.
21.	(c) Addition Product	$NO + FeSO_4 \longrightarrow FeSO_4.NO$ Addition Product (Brown Ring)
22.	(b) Dehydrating agent	$2CH_3COOH + P_2O_5 \longrightarrow (CH_3CO)_2O + 2HPO_3$
23.	(a) Reducing agent	$H_3PO_2 + CuSO_4 + H_2O \longrightarrow H_3PO_4 + H_2SO_4 + Cu$
24.	(a) +1	$S_2Cl_2 = S_2^{+1}Cl_2^{+1}$
25.	(c) $H_4P_2O_7$	H_3PO_4 decomposes at 240°C to $H_4P_2O_7$. $2H_3PO_4 \xrightarrow{240^\circ C} H_4P_2O_7$
26.	(b) Toluene	
27.	(d) $H_2S_2O_7$	It is also called oleum, pyrosulphuric acid or fuming sulphuric acid.
28.	(b) Each molecule produces two H^+ ions.	$H_2SO_4 + H_2O \rightleftharpoons HSO_4^- + H_3O^+$ $HSO_4^- + H_2O \rightleftharpoons SO_4^{2-} + H_3O^+$
29.	(a) Formic acid	$HCOOH \xrightarrow{H_2SO_4} CO + H_2O$
30.	(d) O_2	O_2 is paramagnetic due to presence of two unpaired electrons.
31.	(a) It exists in diatomic state	Other elements of group VI – A do not exit in diatomic state.
32.	(b) It is a gas at room temperature	Other members of group VA are solid at room temperature.
33.	(b) Cl_2	It produces HOCl which kill micro – organism readily by passing through their cell membranes.
34.	(c) Metallic solid	Bi is the last member of VIA group.
35.	(c) Li	$6Li + N_2 \longrightarrow 2Li_3N$
36.	(c) Black	Black phosphorus is most stable and least reactive form of phosphorus.
37.	(b) SiO_2	Na and Mg are softer metals and graphite is softer non-metal but SiO_2 is hardest solid among them.
38.	(b) NH_3	NH_3 reacts with H_2SO_4 to form ammonium sulphate. $2NH_{3(g)} + H_2SO_{4(aq)} \longrightarrow (NH_4)_2SO_{4(aq)}$ Due to formation of $(NH_4)_2SO_4$, NH_3 is to dried by H_2SO_4.

bhatiAcademy

39.	(b) HNO_2	As oxidizing agent:- $2HNO_2 + 2HI \longrightarrow 2H_2O + 2NO + I_2$ As reducing agent:- $HNO_2 + Br_2 + H_2O \longrightarrow HNO_3 + Br_2$
40.	(e) HgS	Cinnabar (HgS) is also called mercuric sulphide.
41.	(d) N_2O_4	N_2O_4 is pale yellow liquid, in solid form it is colourless.
42.	(e) Dehydrating agent	$C_6H_{12}O_6 \xrightarrow{Conc.\ H_2SO_4} 6C + 6H_2O$ $C_{12}H_{22}O_{11} \xrightarrow{Conc.\ H_2SO_4} 12C + 11H_2O$

Short Answers Questions

1. How does nitrogen differ from other elements of its group?

Ans. Nitrogen differs from other elements of its group as follows

Nitrogen	Other Elements of V - A Group
(1) Nitrogen is a gas	(1) Other elements of VA group are solids
(2) It is diatomic molecule	(2) Other elements of VA group are tetra-atomic e.g. P_4, As_4, Sb_4.
(3) It shows a large number of oxidation states. e.g. +5, +4, +3, +2, +1, –1, –2, –3	(3) Other elements show limited no. of oxidation states from +5, +3, & –3.
(4) It occurs in free state as well as in combined states.	(4) The other elements of group V–A occur in combined states only.
(5) It does not form complexes due to non-availability of "d" orbitals.	(5) Other elements which have empty "d" orbitals can accept electron pairs to form complexes.
(6) It is a typical non-metal.	(6) As and Sb are metalloids and Bi is a metal.

2. Why does aqua regia dissolve gold and platinum?

Ans. Aqua regia dissolve gold and platinum as following way:

When one volume of conc. HNO_3 is mixed with 3 volumes of conc. HCl, we get aqua regia. It is employed to dissolve gold and platinum.

$$HNO_{3(conc.)} + 3HCl_{(conc.)} \longrightarrow NOCl_{(aq.)} + 2H_2O + Cl_{2(g)}$$

NOCl formed is decomposed giving NO and Cl_2

$$2NOCl \longrightarrow 2NO + Cl_2$$

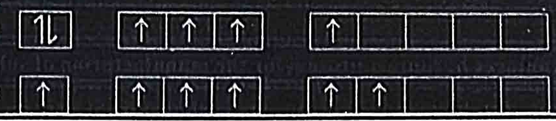
This liberated chlorine gas converts the noble metals such as gold and platinum into their water soluble chlorides.

$$2Au + 3Cl_2 \longrightarrow 2AuCl_3$$
$$Pt + 2Cl_2 \longrightarrow PtCl_4$$

3. Why the elements of group VIA other than oxygen show more than two oxidation states?

Ans. Except oxygen the other members of group VIA show more than two oxidation states because they have empty d orbitals. They show oxidation state −2, +4, +6 for example SCl_2, SCl_4, SCl_6 + 2 oxidation state is shown due to unpaired electrons in the p-orbitals. +4 oxidation state is shown when 1 electron from "p" orbital is promoted to the next vacant d orbital; while +6 oxidation state is shown when one electron from P and one electron from orbital are promoted to the vacant d orbital.





4. Write down a comparison of the properties of oxygen and sulphur.

Ans. Similarities

i) Both oxygen and sulphur have same outer electronic configuration of $ns^2 np^4$.
ii) Both oxygen and sulphur exhibit allotropic forms.
iii) Both have polyatomic molecules. Oxygen has diatomic O_2 while sulphur has S_2 and S_8 molecules.
iv) Both combine with metals in the form of O^{-2} and S^{-2} with oxidation state -2
v) Both are typical non-metals.

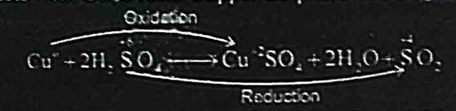
Dissimilarities

Oxygen	Sulphur
There are two allotropic forms of oxygen O_2 and O_3.	There are three allotropic forms of sulphur, rhombic, mono clinic and plastic.
It is gas at ordinary temperature.	It is solid at ordinary temperature.
It is sparingly soluble in Water.	It is insoluble in water.
It helps in combustion.	It is itself combustible.
Oxygen is paramagnetic in nature	Sulphur is diamagnetic in nature.
It does not react with acid.	It is readily oxidized by conc. H_2SO_4 or HNO_3.
It does not react with alkalies.	It reacts with alkali solution and forms sulphides and Thiosulphates.
It shows -2 oxidation state	It shows oxidation state of -2, +2, +4, and +6.

5. Write down the equation for the reaction between conc. H_2SO_4 and copper and explain what type of reaction is it.

Ans. Reaction between conc. H_2SO_4 and coppe

Hot conc. Sulphuric acid reacts with Cu to form Copper Sulphate and SO_2.



$$Cu^0 + 2H_2S^{+6}O_4 \longrightarrow Cu^{+2}SO_4 + 2H_2O + S^{+4}O_2$$

In this reaction, the oxidation state of Cu is changed from "zero" to "2" in $CuSO_4$ and thus Cu is oxidized. The oxidation state of S in H_2SO_4 is +6 whereas in SO_2 it is +4. This show that sulphur is reduced.

Therefore the reaction is an oxidation reduction.

6. Which metals evolve hydrogen upon reaction with nitric acid? Illustrate along with chemical equations.

Ans. Magnesium,Calcium and Manganese give hydrogen with dilute nitric acid.

$$Mg_{(s)} + 2HNO_{3(dil)} \longrightarrow Mg(NO_3)_{2(aq)} + H_{2(g)}$$
$$Ca_{(s)} + 2HNO_{3(dil)} \longrightarrow Ca(NO_3)_{2(aq)} + H_{2(g)}$$
$$Mn_{(s)} + 2HNO_{3(dil)} \longrightarrow Mn(NO_3)_{2(aq)} + H_{2(g)}$$

7. What is meant by fuming nitric acid?

Ans. **Fuming Nitric acid:**

A mixture of conc. HNO_3 and NO_2 is called fuming nitric acid. It is more reactive than conc. HNO_3. It is a red or pale yellow fuming liquid.

bhatti academy

8. Give the advantages of contact process for the manufacturing of sulphuric acis (H_2SO_4)

Ans. The advantages of contact process for the manufacture of H_2SO_4 are given below:-

(i) By using this process, we can get H_2SO_4 of any required concentration.
(ii) As no by product is obtained during this process. So, it is a environment friendly process.
(iii) It is used in commereial preparations.
(iv) The catalyst used i.e. V_2O_5 is solid. So, it can be handled easily.

9. Why is SO_3 dissolved in H_2SO_4 and not in water?

Ans. When SO_3 is dissolved in 98% H_2SO_4, pyrosulphuric acid (oleum) is obtained.

$$H_2SO_{4(aq)} + SO_{3(g)} \longrightarrow H_2S_2O_{7(l)}$$

Oleum can be converted to sulphuric acid of any required concentration. By mixing adequate amount of water.

$$H_2S_2O_{7(l)} + H_2O_{(l)} \longrightarrow 2H_2SO_{4(aq)}$$

While SO_3 is not dissolved in water directly because

(i) The reaction is highly exothermic.
(ii) SO_3 is less soluble in H_2O at high temperature.
(iii) A dense fog is produced which does not easily condense.
(iv) Sulphuric acid of required concentration cannot be prepared.

10. Describe "Ring test" for the confirmation of the presence of nitrate ions in solution.

Ans. Ring test

It is used for the confirmation of nitrate radicals. In this test, to the aqueous solution of salt, add freshly prepared $FeSO_4$ solution. Then conc. H_2SO_4 is added along the inside wall of test tube. A dark-brown ring is formed at the junction of two layers.

$$FeSO_4 + NO \longrightarrow FeSO_4.NO \text{ (brown ring)}$$
(Nitrosoferrous Sulphate)

11. NO_2 is a strong oxidizing agent. Prove the truth of this statement giving examples.

Ans. NO_2 is a strong oxidizing agent

NO_2 is a strong oxidizing agent and oxidizes H_2S to sulphur, ferrous sulphate to ferric sulphate and KI to iodine.

(i) $H_2S_{(g)} + NO_{2(g)} \longrightarrow H_2O_{(l)} + S_{(s)} + NO_{(g)}$

(ii) $2FeSO_{4(aq)} + H_2SO_{4(aq)} + NO_{2(g)} \longrightarrow Fe_2(SO_4)_{3(aq)} + H_2O_{(l)} + NO_{(g)}$

(iii) $2KI_{(aq)} + 2NO_{2(g)} \longrightarrow 2KNO_{2(aq)} + I_{2(s)}$
(Potassium Nitrite)

12. Write down the chemical equations and names of the products formed as a result of the reaction of HNO_3 with arsenic and antimony.

Ans. Arsenic and antimony are metalloids they can be oxidized to their corresponding acids when react with Conc. Nitric acid.

$As_{(s)} + 5HNO_{3(aq)} \longrightarrow H_3AsO_{4(aq)} + 5NO_{2(g)} + H_2O_{(l)}$
Arsenic (Arsenic Acid)

$Sb_{(s)} + 5HNO_{3(aq)} \longrightarrow H_3SbO_{4(s)} + 5NO_{2(g)} + H_2O_{(l)}$
Antimony (Stibnic Acid)

13. Give the methods of preparation of PCl_3.

Ans. Preparation of PCl_3

It is usually prepared by melting white phosphorus in a retort in an inert atmosphere of CO_2 and current of dried chlorine is passed over it. The vapours of PCl_3 are collected in a flask kept in an ice-bath.

$$2P_{(s)} + 3Cl_{2(g)} \longrightarrow 2PCl_{3(l)}$$

(2) It may also be prepared by the action of phosphorus with thionyl chloride.

$$2P_{(s)} + 3SOCl_{2(l)} \longrightarrow 2PCl_{3(l)} + 2SO_{2(g)} + S_2Cl_{2(s)}$$

14. P_2O_5 is a powerful dehydrating agent. Prove giving example.

Ans. P_2O_5 as a powerful dehydrating agent

P_2O_5 is a powerful dehydrating agent, thus, with HNO_3, H_2SO_4, CH_3COOH and C_2H_5OH, it gives nitrogen pentaoxide, sulphur trioxide, acetic anhydride and ethene respectively.

(i) **Reaction with Nitric Acid**

$$2HNO_{3(aq)} + P_2O_{5(s)} \longrightarrow N_2O_{5(g)} + 2HPO_3$$
(Nitrogen Pentaoxide) (Meta Phosphoric acid)

(ii) **Reaction with sulphuric acid**

$$H_2SO_{4(aq)} + P_2O_{5(s)} \longrightarrow SO_{3(g)} + 2HPO_{3(aq)}$$
(Sulphur trioxide)

(iii) **Reaction with Acetic Acid:**

$$2CH_3COOH_{(aq)} + P_2O_{5(s)} \longrightarrow (CH_3CO)_2O_{(l)} + 2HPO_{3(aq)}$$
(Acetic anhydride)

(iv) **Reaction with Ethyl Alcohol:**

$$C_2H_5OH_{(l)} + P_2O_{5(s)} \longrightarrow C_2H_{4(g)} + 2HPO_{3(aq)}$$
(Ethene)

15. Complete and balance the following chemical equations:

(i) $P + NO \longrightarrow$
(ii) $NO + Cl_2 \longrightarrow$
(iii) $H_2S + NO \longrightarrow$
(iv) $Pb(NO_3)_2 \longrightarrow$
(v) $NO_2 + H_2O \longrightarrow$
(vi) $NO_2 + H_2SO_4 \longrightarrow$
(vii) $HNO_2 + HI \longrightarrow$
(viii) $HNO_2 + NH_3 \longrightarrow$
(ix) $HNO_2 + CO(NH_2)_2 \longrightarrow$
(x) $KNO_3 + H_2SO_4 \longrightarrow$

Ans.
i) $4P + 10\,NO \longrightarrow 2P_2O_5 + 5N_2$
ii) $2\,NO + Cl_2 \longrightarrow 2NOCl$
iii) $H_2S + 2NO \longrightarrow H_2O + N_2O + S$
iv) $2Pb(NO_3)_2 \longrightarrow 2PbO + 4NO_2 + O_2$
v) $2NO_2 + H_2O \longrightarrow HNO_3 + HNO_2$
vi) $2NO_2 + H_2SO_4 \longrightarrow NOHSO_4 + HNO_3$ (Nitrosyhydrogen sulphate)
vii) $2HNO_2 + 2HI \longrightarrow 2H_2O + 2NO + I_2$
viii) $HNO_2 + NH_3 \longrightarrow NH_4NO_2$ (Ammonium Nitrite)
ix) $2HNO_2 + CO(NH_2)_2 \longrightarrow 2N_2 + CO_2 + 3H_2O$
x) $KNO_3 + H_2SO_4 \longrightarrow KHSO_4 + HNO_3$ (Potassium hydrogen sulphate)

16. What is laughing gas?

Ans. Laughing gas

When N_2O gas is mixed with little oxygen, if inhaled for sufficiently long time produces hysterical laughter. Thus it is called laughing gas. It acts as mild anaesthetic agent and used in dental surgery.

bhattiAcademy

17. Explain temperature effect on NO_2 gas.

Ans. Effect of temperature on NO_2 gas

On cooling, NO_2 is converted into yellow liquid which can be frozen to a colourless solid dinitrogen tetraoxide (N_2O_4). If this solid is heated to 140°C, the mixture contains NO_2 and N_2O_4 but above 140°C NO_2 is converted to NO and O_2 molecules which are colourless. This decomposition is completed at 620°C.

$$\underset{\text{Pale Yellow}}{N_2O_{4(l)}} \overset{140^\circ C}{\rightleftharpoons} \underset{\text{Reddish brown}}{2NO_{2(g)}} \overset{620^\circ C}{\rightleftharpoons} \underset{\text{Colourless gases}}{2NO_{(g)} + O_{2(g)}}$$

18. How red phosphorus is prepared from white phosphorus?

Ans. Preparation of red phosphorus from white phosphorus

Red phosphorus is prepared by heating white phosphorus in the presence of little iodine or sulphur as a catalyst upto 250°C in vacuum. The tetra-atomic molecules of red phosphorous combine to form macro-molecule.

White phosphorus $\xrightarrow[I_2/s]{250^\circ C}$ Red phosphorus

19. What is the action of cold and hot water with P_2O_3 and P_2O_5?

Ans. With Cold Water

- P_2O_3 reacts with cold water to give phosphorus acid
  $P_2O_{3(g)} + 3H_2O_{(l)} \longrightarrow 2H_3PO_{3(s)}$
- P_2O_5 reacts with cold water and metaphosphoric acid is produced.
  $P_2O_{5(s)} + H_2O_{(l)} \longrightarrow 2HPO_{3(aq)}$

With Hot Water

- P_2O_3 reacts with hot water to form phosphine and phosphoric acid
  $2P_2O_{3(g)} + 6H_2O_{(l)} \longrightarrow 3H_3PO_{4(aq)} + PH_{3(g)}$
- **P_2O_5 reacts with hot water and orthophosphoric acid is produced.**
  $P_2O_{5(s)} + 3H_2O_{(l)} \longrightarrow 2H_3PO_{4(aq)}$

0. Why red phosphorus is denser and chemically less reactive than white phosphorus?

ns. Red phosphorus is regarded as a polymer consisting of chains of P_4 tetrahedral linked together. This makes red phosphorus denser and less reactive. On the other hand, in white phosphorus each phosphorus atom is linked to each of the other three atoms by covalent bonds. The P–P bond length is equal to 2.21 Å. The bond angle is equal to 60° which suggests that the molecule is under strain and hence active in nature.

1. Nitric acid acts as oxidizing agent while nitrous acid can act both as an oxidizing and a reducing agent.

ns. In HNO_3, the oxidation state of nitrogen is +5. Nitrogen can only be converted into lower oxidation states as +5 state is the highest. Thus, it acts only as an oxidizing agent. In nitrous acid (HNO_2) nitrogen is in +3 oxidation state. Thus it can be lowered or raised. Hence HNO_2 acts both as an oxidizing and a reducing agent.

2. Sugar turns black on addition of conc. H_2SO_4.

ns. Conc. H_2SO_4 has great affinity for water molecules, i.e., it acts as dehydrating agent. When in contact with sugar, all water molecules are taken up and carbon is left behind.

$$C_{12}H_{22}O_{11} \xrightarrow{\text{Conc. } H_2SO_4} 12C + 11H_2O$$

3. Oxygen is a gas while sulphur is a solid.

ns. The oxygen molecule is diatomic involving a double bond. Its small size produce weak intermolecular forces amongst its molecules and is, thus, a gas at room temperature. Sulphur is incapable of forming π-bonds. Its molecule has puckered ring structure of eight sulphur atoms joined by single covalent bonds. The intermolecular forces acting between S_8 molecules are stronger and hence, sulphur is a solid.

****

CHAPTER 5

The Halogens And The Noble Gases

Solved Objective Exercise

Q1. Fill in the blanks.

(i) The halogen with the highest electronegativity is ____
(ii) HI is _____ agent.
(iii) The only halogen acid which is not a strong acid is _____
(iv) Tincture of _____ is a common antiseptic.
(v) The halogen with the lowest melting and boiling points is _____.
(vi) Bleaching powder is prepared from _____ and ____
(vii) _____ is the halogen which causes burns on the skin which heal slowly.
(viii) _____ is used for making unshrinkable wool.
(ix) A mixture of _____ and _____ is used for breathing by the sea divers.
(x) Noble gas used to fill fluorescent tubes is _____.

Answer Key.

(i)	Fluorine	(ii)	Reducing
(iii)	HF	(iv)	Iodine
(v)	Fluorine (F_2)	(vi)	$Ca(OH)_2$, Cl_2
(vii)	Bromine	(viii)	Bleaching powder
(ix)	80% He and 20% O_2	(x)	Krypton and Argon

Q2. Indicate True or false.

(i) HF is used for etching glass,
(ii) HI is weaker reducing agent as compared to HF.
(iii) Bleaching powder is completely soluble in water.
(iv) The formula of perchloric acid is $HClO_2$.
(v) On warming, aqueous KOCl disproportionates as follows. $3KOCl \rightarrow 2KCl + KClO_3$
(vi) α-particles emitted by radioactive elements are ions of radon.
(vii) Radon is the only one of the noble gases that is radioactive.
(viii) The molecules of the noble gases are all monoatomic
(ix) Argon is used to fill electric bulbs.
(x) The noble gas which is present in the largest amount in atmosphere is krypton.

Answer Key.

(i)	True	(ii)	False	(iii)	True	(iv)	False	(v)	True
(vi)	False	(vii)	True	(viii)	True	(ix)	True	(x)	False

Prentice Hall Academy

Q3. Multiple Choice Questions. Encircle the correct answer.

(i) Which of the following hydrogen halide is the weakest acid in solution?
(a) HF (b) HBr (c) HI (d) HCl

(ii) Chlorine heptaoxide (Cl_2O_7) reacts with water to form.
(a) Hypochlorous acid (b) Chloric acid
(c) Perchloric acid (d) Chlorine and oxygen

(iii) Hydrogen bond is the strongest between the molecules of:
(a) HF (b) HCl (c) HBr (d) HI

(iv) Which halogen will react spontaneously with $Au_{(s)}$ to produce Au^{3+}?
(a) Br_2 (b) F_2 (c) I_2 (d) Cl_2

(v) The anhydride of $HClO_4$ is:
(a) ClO_3 (b) ClO_2 (c) Cl_2O_5 (d) Cl_2O_7

(vi) Bleaching powder may be produced by passing chlorine over:
(a) calcium carbonate (b) hydrated calcium sulphate
(c) anhydrous calcium sulphate (d) calcium hydroxide

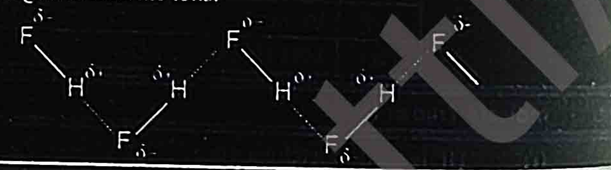
(vii) Which halogen occurs naturally in a positive oxidation state?
(a) Fluorine (b) Chlorine (c) Bromine (d) Iodine

(viii) Which is the strongest acid?
(a) HClO (b) $HClO_2$ (c) $HClO_3$ (d) $HClO_4$

(ix) An element that has a high ionization energy and tends to be chemically inactive would most likely to be:
(a) an alkali metal (b) a transition element (c) a noble gas (d) a halogen

(x) Which of the following represents the correct electronic configuration of the outermost energy level of an element of zero (VIIIA) group in the ground state.
(a) s^2p^4 (b) s^2p^5 (c) s^2p^6 (d) s^2p^6

Solved Exercise MCQ's

Q. No	Answer	Reason
(i)	(a) HF	HF is weakest acid because partially positive hydrogen ion is entrapped b/w highly electronegative fluorine ions. 
(ii)	(c) Perchloric acid	$Cl_2O_7 + H_2O \longrightarrow 2HClO_4$ Cl_2O_7 is anhydride of perchloric acid.
(iii)	(a) HF	Electronegativity difference between H(2.1) and F(4.0) is 1.9 which is maximum so H-bond is formed which is strongest.
(iv)	(d) Cl_2	Cl_2 reacts spontaneously with $Au_{(s)}$ to form Au^{3+}, so gold becomes dissolved due to formation of soluble chloride. This process is used in aqua regia.
(v)	(d) Cl_2O_7	$2HClO_4 \xrightarrow[-H_2O]{} Cl_2O_7$
(vi)	(d) Calcium hydroxide	$Ca(OH)_2 + Cl_2 \longrightarrow \underset{\text{Bleaching Powder}}{Ca(OCl)Cl} + H_2O$
(vii)	(d) Iodine	In $NaIO_3$ oxidation state of 'I' is + 5 & in $NaIO_4$, oxidation state is +7.
(viii)	(d) $HClO_4$	$HClO_4$ is strongest acid because oxidation state of halogen increases and

		binding electrons are shifted away from hydrogen. and hydrogen is released comparatively easily.
(ix)	(c) A noble Gas	Noble Gas has complete valence shell so it tends to be inactive.
(x)	(d) s^2p^6	VIII A group elements have eight electrons in their valence shell so their valence shell electronic configuration is s^2p^6.

Previous Boards MCQ's

1. Which of the gases is used in bacterial lamps (D.G Khan 08, Lhr 12)
(a) Neon (b) Fluorine (c) Xenon (d) Chlorine
2. Radon is used in radio therapy. It's best source is (D.G Khan 09)
(a) Liquefaction of air (b) Radioactive decay of Ra - 226
(c) Fractional distillation of mixture of noble bases (d) all
3. Strongest reducing agent is (D.G Khan 10)
(a) HF (b) HBr (c) HCl (d) HI
4. Among the given ionic halides which one have highest melting and boiling points (D.G Khan 10)
(a) Iodides (b) Bromides (c) Fluorides (d) Chlorides
5. Most powerful oxidizing agent (Rwp 08)
(a) Cl_2 (b) Br_2 (c) F_2 (d) I_2
6. Which of the following halogens is solid at room temperature? (Rwp 09)
(a) F_2 (b) Cl_2 (c) Br_2 (d) I_2
7. Gas used as a cooling medium for nuclear reactor is (Rwp 10)
(a) H_2 (b) Cl_2 (c) He (d) SO_2
8. Which is used as a non-stick coating for cooking pans? (Fsd 08)
(a) Freon (b) Teflon (c) Argon (d) Krypton
9. The anhydride of $HClO_4$ is (Grw 08, Fsd 09, Fsd Supp 10, Lhr 08, 09)
(a) ClO_3 (b) ClO_2 (c) Cl_2O_5 (d) Cl_2O_7
10. The halogen present in Teflon is (Fsd 10)
(a) Iodine (b) Fluorine (c) Chlorine (d) Bromine
11. Which is the strongest acid (Sgr 09, 10, Fsd 10)
(a) HClO (b) $HClO_2$ (c) $HClO_3$ (d) $HClO_4$
12. Hydrogen bond is the strongest between the molecules of (Grw 09)
(a) HCl (b) HF (c) HBr (d) HI
13. Goiter is caused due to the deficiency of (Grw 10)
(a) Fluorine (b) bromine (c) chlorine (d) iodine
14. The strongest acid is (Grw 11)
(a) HF (b) HBr (c) HCl (d) HI
15. Fungicides are the pesticides which (Grw 11, Sgr 10)
(a) Control the growth of fungus (b) kill insects (c) kill plants (d) kill herbs
16. Silver bromide is used in (Lhr 10)
(a) Paints (b) Photography (c) Ceramics (d) Gasoline
17. The element which causes burn to skin that heels slowly (Lhr 11)
(a) F (b) Cl (c) Br (d) Acid
18. Xenon has kinds of oxides: (Lhr 12)
(a) 2 (b) 3 (c) 4 (d) 1
19. Which halogen is used as an insecticide? (Grw 12)
(a) Br_2 (b) I_2 (c) Cl_2 (d) F_2

Entry Test MCQ's

1. The property of halogens, that indicated incorrect is
(a) F > Cl > Br > I..... ionization energy (b) F > Cl > Br > I..... electron affinity
(c) F > Cl > Br > I..... electronegativity (d) I > Br > Cl > F..... density in liquid state

2. The halogen that is most readily reduced is
(a) Fluorine (b) Bromine (c) Chlorine (d) Iodine

3. Tincture of iodine is
(a) Aqueous solution of I_2 (b) Alcoholic solution of I_2
(c) Solution of iodine in aqueous KI (d) Aqueous solution of KI

4. What products are expected from disproportionation reaction of hypochlorous acid?
(a) $HClO_3$ and Cl_2O (b) HCl and Cl_2O
(c) $HClO_2$ and $HClO_4$ (d) HCl and $HClO_3$

5. Fluorine is the best oxidizing agent because it has
(a) Highest electron affinity (b) Highest E°_{red}
(c) Highest E°_{red} (d) Lowest electro negativity

6. Which one of the following is the strongest oxidizing agent?
(a) HClO (b) $HClO_2$ (c) $HClO_3$ (d) $HClO_4$

7. The colour of iodine solution is discharged by shaking with
(a) Aqueous sulphur dioxide (b) sodium sulphate (c) sodium sulphide (d) Sodium chloride

8. Chlorine cannot be prepared by the action of HCl on
(a) MnO_2 (b) NaCl (c) $KMnO_4$ (d) $K_2Cr_2O_7$

9. One gas bleaches the colour of flowers by reduction and other by oxidation. These gases are
(a) SO_2 and Cl_2 (b) NH_3 and SO_2 (c) CO and Cl_2 (d) H_2S and Br_2

10. Elements of which one of the following groups will form anions most readily?
(a) Oxygen group (b) halogens (c) nitrogen group (d) Alkali metals

11. Slaked lime reacts with chlorine to form
(a) $Ca(OCl)_2$ (b) $Ca(ClO_3)_2$ (c) $Ca(OCl)Cl$ (d) $CaCl_2$

12. A substance X when heated with conc. H_2SO_4 liberates a gas which turns starch paper blue. The substance X is
(a) NaI (b) NaCl (c) NaBr (d) $NaNO_3$

13. Available chlorine is liberated from bleaching powder when it is
(a) Heated (b) Reacted with excess of acid solution
(c) Reacted with alkali solution (d) Reacted with water

14. Bleaching properties of bleaching powder are due to its
(a) Oxidizing properties (b) Basic properties
(c) Reducing properties (d) Disinfecting properties

15. Chlorine acts as a bleaching agent only in the presence of
(a) Dry air (b) Moisture (c) Sunlight (d) Pure oxygen

16. When bleaching powder is treated with carbon dioxide
(a) Chlorine is evolved (b) No reaction occurs
(c) Calcium chloride is formed (d) It absorbs the gas

17. Among the halogens, the one which is oxidized by nitric acid is
(a) Fluorine (b) Bromine (c) Chlorine (d) Iodine

18. Noble gases are chemically inactive because of
(a) Mono-atomic nature (b) Closed valence shell
(c) Low boiling points (d) Rare occurrence

19. Of the following species, one which is non-existent
(a) XeF_6 (b) XeF_4 (c) XeF_5 (d) XeF_2

20. Xenon difluoride is
(a) linear (b) Trigonal (c) Angular (d) Pyramidal

21. A radioactive element which can decay to give two noble gases, is
(a) U^{238} (b) Ac^{239} (c) Th^{232} (d) Ra^{226}

22. The coloured discharge tube for advertisement mainly contains
(a) Xenon (b) Neon (c) Helium (d) Argon

23. XeF_6 on complete hydrolysis gives
(a) Xe (b) XeO_3 (c) XeO_2 (d) XeO_4

24. Which of the following statements is not correct?
(a) Argon is used in electric bulbs (b) Krypton is obtained during radioactive disintegration
(c) Half-life of radon is only 3.8 days (d) Helium is used in producing very low temperatures

25. Green vitriol is formed by
(a) $FeS_2 + CO$ (b) $FeS_2 + H_2O + O_2$ (c) $FeS_2 + H_2O + CO_2$ (d) $FeS_2 + CO + CO_2$

Additional MCQ's

1. Which one of the following has maximum bond energy?
(a) F_2 (b) Br_2 (c) Cl_2 (d) I_2

2. The most inert among the noble gases is:
(a) Neon (b) Argon (c) Xenon (d) Helium

3. Chlorine occurs in:
(a) Free state (b) Combined state (c) Both a and b (d) None of these

4. Cl_2 when reacts with cold and dilute NaOH, it forms:
(a) Hypochlorite (b) Chlorite (c) Perchlorate (d) Chlorate

5. Which one of the following is not use of chlorine:
(a) Formation of PVC (b) Formation of mustard gas
(c) Disinfectant and bleaching agent (d) Formation of sodium chloride

6. Colour of which halogen is not correctly related:
(a) F_2-Colorless (b) Cl_2Greenish Yellow
(c) Br_2-Reddish brown liquid (d) I_2-Greyish black solid

7. Which of the following halogen form maximum compounds with xenon:
(a) F_2 (b) Cl_2 (c) Br_2 (d) I_2

8. The chemical formula of iodic acid is:
(a) HI (b) HIO (c) HIO_2 (d) HIO_3

9. Which one of the following gas exist in monoatomic form:
(a) Ozone (b) Nitrogen (c) Krypton (d) Phosphine

10. In which compound, the oxidation state of xenon is not +6:
(a) $XeOF_2$ (b) $XeOF_4$ (c) XeO_3 (d) XeF_6

11. The oxy-acids of halogen in which oxidation state of halogen is +1 are named as:
(a) -ic acids (b) Per-ic acids (c) -ous acids (d) Hypo-ous acid

12. The factor which does not effect the oxidising power of a halogen is :
(a) Energy of dissociation (b) Electron Affinity (c) Heat of hydration (d) Ionization energy

13. Smaller quantity of chlorine reacts with ammonia to form:

khatri Academy

(a) N_2 (b) NCl_3 (c) SO_2 (d) SO_3

14. What is the color of bromine?
(a) Reddish Brown (b) Orange red (c) Yellow (d) Green

15. Bleaching powder reacts with a concentrated solution of ammonia to give:
(a) Hydrogen gas (b) Nitrogen gas (c) Oxygen gas (d) Chlorine gas

16. What is the colour of bleaching powder :
(a) Blue (b) Yellowish White (c) Green (d) Red

ANSWERS TO MCQ'S

Previous Boards MCQ's

Q.No	Answer	Reason
1.	(e) Xenon	Xenon gas is used in bactericidal lamps as it kills bacteria.
2.	(d) all	Radon can be obtained from liquefaction of air, fractional distillation of mixture of noble gases & by radioactive decay of Ra – 226 e.g., $^{226}Ra \longrightarrow {}^{222}Rn + {}^{4}He$
3.	(d) HI	HI is strongest acid and easily releases hydrogen so it is strongest reducing agent.
4.	(e) Fluorides	Fluorine has highest electronegativity value so ionic bonds formed by it are stronger as a result melting and boiling point of fluorides have highest.
5.	(e) F_2	F_2 has low energy of dissociation and highest hydration energy so it has highest oxidizing power.
6.	(d) I_2	I_2 is solid at room temperature because it has highest polarization due to large size. As a result, intermolecular forces are strongest.
7.	(c) He	Helium is a noble gas which provides cooling medium for nuclear reactions.
8.	(b) Teflon	Teflon is polymerized tetrafluoroethylene $[-CF_2-CF_2-]_n$
9.	(d) Cl_2O-	$Cl_2O + H_2O \longrightarrow 2HClO$
10.	(b) Fluorine	Teflon is polymerized tetrafluoro-ethylene $[-CF_2-CF_2-]_n$
11.	(d) $HClO_4$	The oxidation state of Cl in $HClO_4$ is "+7" due to which binding electrons are shifted away from hydrogen and its acidic strength increase.
12.	(b) HF	H – bond is strong in HF because of high electronegativity value of fluorine.
13.	(d) Iodine	Diet with insufficient iodide ions leads to an enlargement of "thyroid" goiter.
14.	(d) HI	HI is strongest acid due to weak H-I bond.
15.	(a) Control the growth of fungus.	Fungi – fungus ; cide – to kill
16.	(b) Photography	Silver bromide (AgBr) is obtained by the action of Br_2 on silver.
17.	(c) Br_2	Bromine causes burns that heal slowly.
18.	(a) 2	i) Xenon trioxide ii) Xenon tetraoxide
19.	(c) Cl_2	Cl_2 is used to kill insects.

Entry Test MCQ's

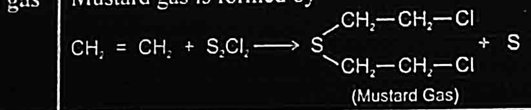
1.	(b) F> Cl > Br > I .....electron affinity	Electron affinity value of "Cl" is higher (349 kJ/mol) than that of "F" which is 322 kJ/mol.
2.	(d) Iodine	Iodine is most easily reduced because it is weak oxidizing agent due to low electron affinity value.
3.	(c) Solution of I_2 in aqueous KI	It is mixture of I_2 and KI dissolved in rectified alcohol. It is used as antiseptic.

4.	(d) HCl and $HClO_3$	$3HClO \longrightarrow 2HCl + HClO_3$
5.	(b) Highest $E^{\circ}_{red.}$	Greater the $E^{\circ}_{red.}$ greater will be oxidizing character.
6.	(a) HClO	In HClO, the oxidation state of chlorine is "+1" due to which removed of "O" is quite easy so it is powerful oxidizing agent.
7.	(a) Aqueous sulphur dioxide	$SO_2 + I_2 + 2H_2O \longrightarrow H_2SO_4 + 2HI$
8.	(b) NaCl	NaCl does not evolved Cl_2 gas on reacting with HCl. It produces Cl_2 gas when treated with acidic MnO_2.
9.	(a) SO_2 and Cl_2	SO_2 is a reducing agent which Cl_2 is an oxidizing agent.
10.	(b) Halogens	Halogens form anions more readily due to their higher electron affinity values.
11.	(c) Ca (OCl)Cl	$Ca(OH)_2 + Cl_2 \longrightarrow Ca(OCl)Cl + H_2O$ (Bleaching powder)
12.	(a) NaI	Iodine gives blue colour with starch.
13.	(b) Reacted with excess of acid solution.	$Ca(OCl)Cl + H_2SO_4 \longrightarrow CaSO_4 + H_2O + Cl_2$ (excess)
14.	(a) Oxidizing properties	This bleaching action is due to generation of hypochlorite ion (OCl$^-$) in aqueous solution.
15.	(b) Mixture	$H_2O + Cl_2 \longrightarrow 2HCl + [O]$ Coloured compound + [O] $\longrightarrow$ Colourless compound
16.	(d) It absorbs the gas	Bleaching powder absorbs CO_2 gas and forms $CaCO_3$ $Ca(OCl)Cl + CO_2 \longrightarrow CaCO_3 + Cl_2$
17.	(d) Iodine	$I_2 + 10HNO_3 \longrightarrow 2HIO_3 + 10NO_2 + 4H_2O$
18.	(b) Closed valence shell	Due to closed valence shell, they obey duplet or octet rule and are chemically inactive.
19.	(c) XeF_6	In XeF_6, Oxidation state of Xe is +5 which is non existing.
20.	(a) Linear	XeF_2: F–Xe–F
21.	(d) Ra^{226}	$Ra^{226} \longrightarrow Rn^{222} + He^4$
22.	(b) Neon	Neon is used in advertisement signs.
23.	(b) XeO_3	$XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$ $XeOF_4 + 2H_2O \longrightarrow XeO_3 + 4HF$
24.	(b) Krypton is obtained during radioactive disintegration.	Radon is obtained during radioactive disintegration $Ra^{226} \longrightarrow Rn^{222} + He^4$
25.	(b) $FeS_2 + H_2O + O_2$	Green vitriol is $FeSO_4$ and it is formed by reaction of $FeS_2 + H_2O + O_2$

Additional MCQ's

1.	(c) Cl_2	Bond energy of Cl_2 is 242.67 kJ/mol which is maximum.
2.	(b) Argon	Argon is very inert and not known to form any compound.
3.	(c) Both a and b	Chlorine occurs as Cl_2 and also in the form of many compounds e.g., NaCl.
4.	(a) Hypochlorite	$Cl_2 + 2NaOH \longrightarrow NaCl + NaClO + H_2O$

bhatti Academy

5.	(b) Formation of mustard gas	Mustard gas is formed by  (Mustard Gas)
6.	(a) F_2 – Colourless	F_2 has pale yellow colour.
7.	(a) F_2	XeF_2 ; XeF_4 : Xe F_6 , $XeOF_4$ etc.
8.	(d) HIO_3	I_2O_5 reacts with water to form iodic acid. $I_2O_5 + H_2O \longrightarrow 2HIO_3$
9.	(c) Krypton	Krypton is a noble gas and chemically inactive so it exists in monoatomic form.
10.	(a) $XeOF_2$	In $XeOF_2$, oxidation state of Xe is + 4
11.	(d) Hypo – ous acid	e.g., Hypochlorous acid (HClO), in HClO Oxidation state of Cl is '+1'
12.	(d) Ionization energy	Oxidizing power depends upon energy of dissociation, electron affinity and heat of hydration and is independent of ionization energy.
13.	(b) NCl_3	$NH_3 + 3Cl_2 \longrightarrow NCl_3 + 3HCl$
14.	(a) Reddish Brown	Bromine is a liquid of reddish brown colour.
15.	(b) Nitrogen Gas	$3Ca(OCl)Cl + 2NH_3 \longrightarrow 3CaCl_2 + 3H_2O + N_2$
16.	(b) Yellowish white	Bleaching powder is a mixed salt.

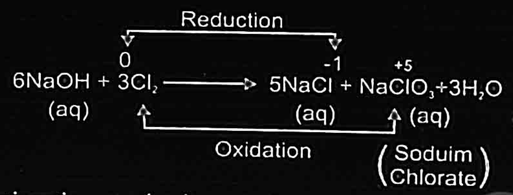
Short Answers Questions

1. What are disproportionation reactions? Explain your answer with an example.

Ans. Disporportionation Reaction:

"A reaction in which a specie (molecule, atom or ion) is simultaneously oxidized and reduced is called disporportionation reaction".

Example:



This reaction is a disporportionation reaction because the zero oxidation state of chlorine atom in Cl_2 is converted to –1 in chloride and +5 in chlorate.

2. How the halogen acids are ionized in water?

Ans. The halogen acids in the gaseous state are essentially covalent. In aqueous solutions, however, they ionize and act as acids. HF is only slightly ionized but HCl, HBr and HI are almost completely ionized, i.e, the relative strength increases from HF to HI. HF is the weakest acid and HI is the strongest acid.

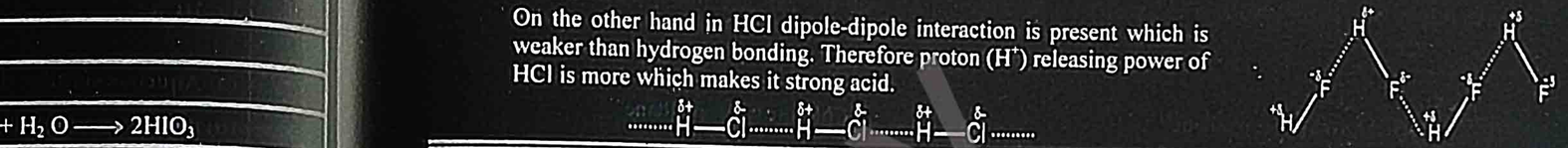
3. Why HF is weaker acid than HCl?

Ans. HF is a weaker acid than HCl:

A substance which has a tendency to give proton (H^+) in an aqueous solution is called acid. The strength of an acid is directly proportional to its proton (H^+) releasing power.

In HF strong hydrogen bonding is present and partially positive hydrogen is entrapped between two strong electronegative fluorine atoms.Consequently it become difficult for proton to be ionized in water which makes it weak acid.

On the other hand in HCl dipole-dipole interaction is present which is weaker than hydrogen bonding. Therefore proton (H^+) releasing power of HCl is more which makes it strong acid.



4. In the following sets, arrange the substances in order of the property indicated. Give reasons.

(a) Increasing acidic character $HClO$, $HClO_2$, $HClO_3$, $HClO_4$

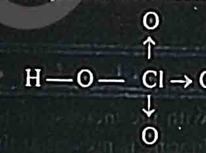
(b) Increasing oxidizing power F_2, Cl_2, Br_2, I_2

Ans. Arrange and give reasons:

(a) Increasing acidic character;

Reason:

The strength of oxy acids of Halogens increases with increase in Number of oxygen atoms. As the oxidation state of halogen atom in oxyacids increases, the bonding electrons are shifted away from hydrogen atom and tendency of molecules to lose proton increases. This account for increasing the strength of oxy-acids.



Thus increasing order of acidic strength of oxy-acids is

$HClO < HClO_2 < HClO_3 < HClO_4$

(b) Increasing oxidizing power:

Reason:

The oxidizing power of halogens depends upon following factors:

(i) Energy of dissociation

(ii) Electron affinity of atoms

(iii) Hydration energy of ions

(iv) Heat of vapourization (for Br_2 and I_2)

If halogen has low energy of dissociation, a high electron affinity and a higher hydration energy of its ions, it will have high oxidizing power.

Thus, the order of increasing oxidizing power of halogens is

$$I_2 < Br_2 < Cl_2 < F_2$$

5. What is Iodized salt?

Ans. Iodized salt:

"When common salt (NaCl) contains 0.02% KI by weight, it is called iodized salt".

- Sodium iodide can also be used in common salt to get iodized salt.

Diet with unsufficient iodide ions leads to an enlargement of "thyroid" (Goiter). To ensure the presence of iodide ions in the diet, iodized table salt is used to prevent goiter.

6. What are Freons and Teflon?

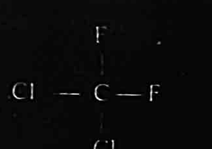
Ans. Freons:

"Freon is the commercial name of low molecular mass Fluorochlorocarbons."

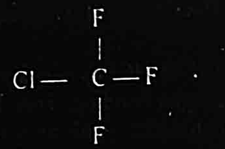
- Fluorune is used for preparation of freons.

bhattiAcademy

Example:-



"Dichlorodifluoromethane"



"Chlorotrifluoromethane"

Uses:

Freons are being used as refrigerants and aerosol propellants.

Teflons:

"It is a polymerized tetra-fluoroethylene compound".

Fluorine is used to prepare Teflon.



Uses:

(i). It is a valuable plastic which resists the action of oxidants, acids and alkalies.
(ii). Corrosion proof parts of machinery are made of it.
(iii). It is used for coating the electrical wiring.
(iv). It is used as an non-stick coating for cooking pans.

7. Arrange the following ions in order of increasing size: F^-, Cl^-, I^-, Br^-

Ans. In a group ionic radii is in increasing order from top to bottom with the increase in no. of shells and shielding effect and decrease of attractions of electrons towards nucleus. Fluorine is present at the top of VII-A group and its ion (F^-) is smaller as compare to the size of I^- ion.

Thus, the arrangement of given ions in increasing order is

$$F^- < Cl^- < Br^- < I^-$$

8. Why iodine has metallic luster?

Ans. Metallic Luster of iodine is due to the excitation and than de-excitation of valence electrons. Due to bigger size of iodine molecule valence electrons experience weak nuclear attraction. When light falls on iodine surface weakly bounded valence electrons by absorbing energy go into excited state. These excited electrons when de-excite they emit energy in the form of radiations. These radiations give greyish-black metallic luster to iodine.

9. Which halogen sublimes to violet vapours?

Ans. "A substance which upon heating directly converts into vapours without passing through liquid phase is called sublime."

Among halogens F_2 and Cl_2 are gases at room temperature while Br_2 exists as a liquid and on the other I_2 as a solid. Due to having weak intermolecular forces halogens convert into violet vapours upon heating.

10. Which halogen is used as an antiseptic?

Ans. Both chlorine and bromine are used as antiseptic.

11. Which halogen is used in water treatment to kill becteria?

Ans. Chlorine.

12. Name the gas, which is used for earthquake prediction.

Ans. Among noble gases, radon (Rn) being radioactive is used for earthquake prediction.

13. Name the gas, which is used in bactericidal lamps.

Ans. Xenon (Xe) is used in bactericidal lamps.

14. Why $HClO_3$ is stronger acid than $HBrO_3$?

Ans. The oxyacids of chlorine are stronger than the corresponding oxyacids of bromine. Which are in turn stronger then the corresponding oxyacids of iodine. It is due to

- Decrease in electronegativity of halogens down the group.
- Increase in the size of halogens.

That's why $HClO_3$ is stronger acid than $HBrO_3$.

15. Why is the electron affinity of fluorine less than chlorine?

Ans. The electron affinity of fluorine is lesser than chlorine because electron affinity is actually sum of two energies.

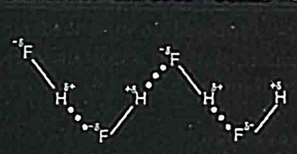
(i) Energy required to overcome repulsion of electrons already present in the valance shell.
(ii) Energy released after the addition of electron because atom gets stabilized

In case of Fluorine due to small size, repulsion of electronic cloud is so strong that large amount of energy is required to overawe the repulsion. Therefore, overall value of E.A. becomes less than chlorine.

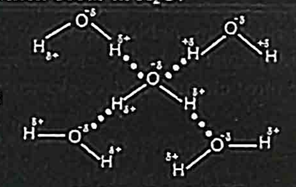
Electron affinity of Fluorine = 322 kJ/mole
Electron affinity of Chlorine = 349 kJ/mole

16. The viscosity of water is more than HF. Justify.

Ans. Pure liquid HF is strongly hydrogen bonded and is a viscous liquid but its viscosity is less than water due to absence of three dimensional network of H – bonds which occur in H_2O.



H-bonding in HF



H- bonding In H_2O

17. Fluorine is restricted to only -1 oxidation state. Why?

Ans. Fluorine is restricted to only -1 oxidation.

The reason lies in the fact that fluorine contains 7 electrons in its outermost shell and it needs only 1 electron to atom configuration of nearest noble gas. As it is easy to add 1 electron then to remove 7 electrons, Thus the oxidation state of fluorine is -1.

18. Boiling point of HCl is lower than HF.

Ans. In HF, there is one hydrogen bonding per molecule. It is, therefore, an associated liquid. No hydrogen bonding is present in HCl. Only van der Waals' forces are present. That is why boiling point of HCl (-85°C) is lower HF (19.5°C).

19. F–F bond in fluorine is weaker than Cl–Cl bond in chlorine.

Ans. The dissociation energy of F–F bond (154kJ/mol) is lower than Cl–Cl bond (243kJ/mol). The low dissociation energy of fluorine is due to high interelectronic repulsions between non-bonding electrons in the 2p-orbitals as the size of fluorine atom is small. As a result F–F bond is weaker than Cl–Cl.

20. Bleaching powder loses its bleaching property when kept in an open bottle for a long time.

Ans. Bleaching action of bleaching powder is due to release of Cl_2 at the time of application. Chlorine is lost by bleaching powder on long standing in open air by the following two processes.

(a) $CaOCl_2 + CO_2(air) \longrightarrow CaCO_3 + Cl_2$

(b) $6CaOCl_2 \longrightarrow 5CaCl_2 + Ca(ClO_3)_2$

Thus, $CaCl_2$ and $Ca(ClO_3)_2$ do not release Cl_2 at the time of use.

Hence, bleaching property is lost by bleaching powder on exposure for long time.

21. Halogens are coloured.

Ans. Halogens absorb part of the light in the visible region which cause excitation of outer electrons to higher energy levels. The excitation energy depends on the size of the halogen atom, the smaller the atom, the greater is the ecitation energy. Thus, fluorine absorbs violet light and thus appears yellow (complementary colour). As different colours are absorbed by halogens, they display different complementary colours also.

22. Halogens are strong oxidizing agents.

Ans. Halogens act a strong oxidizing agents because they have high tendency to accept electron i.e. they have high electron affinity values. Their reduction potentials are high (positive) and decrease from F to I. Thus, oxidizing nature decreases from F to I.

23. The bleaching action of chlorine is permanent while that of sulphur dioxide is temporary.

Ans. Chlorine bleaeing action is due to oxidation while that of sulphur dioxide is due to reduction. Hence, the substance bleached by SO_2 is reoxidised by the oxygen of the air to its original state.

24. Pure HI kept in a bottle acquires a brown colour after sometime.

Ans. HI is strong reducing agent. It is even oxidized by oxygen of the air. The iodine is liberated which is dissolved in solution imparting it a brown colour.

25. Why most of noble gas compound involve only fluorine and oxygen?

Ans. Any chemical reactivity shown by noble gases may be attributed on their tendency to lose electrons. For this reason, the combining atom must be highly electronegative, so as to accept these electrons. Xenon forms stable compounds only with the most electronegative elements; fluorine (E.N = 4.0) and oxygen (E.N = 3.5).

****

CHAPTER 6

Transition Elements

Solved Objective Exercise

Q1. Fill in the blanks.

(i) The property of paramagnetism is due to the presence of _____ electrons.
(ii) MnO_4^- ion has ___ colour and $Cr_2O_7^{2-}$ has ___ colour.
(iii) When potassium chromate is treated with an acid _____ is produced.
(iv) The d-block elements are located between _____ and _____ block elements.
(v) Oxidation number of Fe in $K_4[Fe(CN)_6]$ is _____ while in $K_3[Fe(CN)_6]$ it is _____.
(vi) The presence of _____ in a metal promotes corrosion.
(vii) If copper is in contact with aluminum, _____ gets corroded.
(viii) Complexes having sp^3d^2 hybridization have _____ shape.
(ix) In naming the complexes, all the ligands are named in ___
(x) In an aqueous solution CrO_4^{-2} and $Cr_2O_7^{2-}$ exist in the form of _____.

Answer Key

(i)	Unpaired	(ii)	Purple, orange red
(iii)	$K_2Cr_2O_7$	(iv)	s, p
(v)	+2, +3	(vi)	Impurities
(vii)	Aluminum	(viii)	Octahedral
(ix)	Alphabetical order	(x)	Equilibrium

Q2. Indicate True or false.

(i) A substance which is attracted into a magnetic field is said to be diamagnetic.
(ii) Compounds of the transition elements are mostly coloured.
(iii) Fe^{3+} ions are blue when hydrated.
(iv) An extreme case of paramagnetism is called diamagnetism.
(v) Tin plating is used to protect iron sheets from corrosion.
(vi) In galvanizing zinc prevents corrosions of iron.
(vii) Tin plated iron gets rusted more rapidly when the protective coating is damaged than the unplated iron.
(viii) The name of anionic ligands in a complex ends in suffix, O.
(ix) Pig iron contains greater percentage of carbon that steel.
(x) Complex compounds having dsp^2 hybridization have tetrahedral geometry.

Answer Key

(i)	False	(ii)	True	(iii)	False	(iv)	False	(v)	True
(vi)	True	(vii)	True	(viii)	True	(ix)	True	(x)	False

bhattiAcademy

Q3. Multiple Choice Questions. Encircle the correct answer.

(i) Which of the following is a non-typical transition element?
(a) Cr (b) Mn (c) Zn (d) Fe

(ii) Which of the following is a typical transitions metal?
(a) Sc (b) Y (c) Ra (d) Co

(iii) f-Block elements are also called
(a) non-typical transition elements (b) outer transition elements
(c) Normal transition elements (d) None is true

(iv) The strength of binding energy of transition elements depends upon
(a) number of electron pairs (b) number of unpaired electrons
(c) number of neutrons (d) number of protons

(v) Group VIB of transition elements contains
(a) Zn,Cd,Hg, (b) Fe, Ru, Os (c) Cr, Mo,W (d) Mn,Te, Re

(vi) Which is the formula of tetraammineehloronitroplatinums (IV) sulphate?
(a) $[Pt(NH_3)_4(NO_2)]SO_4$ (b) $[PtNO_2Cl(NH_3)_4]SO_4$
(c) $[PtCl(NO_2)(NH_3)_4]SO_4$ (d) $[Pt(NH_3)_4(NO_2)Cl]SO_4$

(vii) The percentage of carbon in different types of iron products is in the order of
(a) cast iron > wrought iron > steel (b) wrought iron > steel > cast iron
(c) cast iron > steel > wrought iron (d) cast iron = steel > wrought iron

(viii) The colour of transition metal complexes is due to
(a) d-d transitions of electrons (b) paramagnetic nature of transition elements
(c) ionization (d) loss of s- electrons

(ix) Coordination number of Pt in $[Pt\,Cl(NO_2)(NH_3)_4]^{2+}$ is
(a) 2 (b) 4 (c) 1 (d) 6

(x) The total number of transition elements is
(a) 10 (b) 30 (c) 40 (d) 58

Solved Exercise MCQ's

(i)	(c) Zn	Zn does not have a partially filled d-orbital either as element or in any of its oxidation state, so it is non-typical transition element.
(ii)	(d) Co	Sc and Y are non-typical transition elements, Ra is not a transition element but Co is a typical transition element.
(iii)	(d) None is true	f – Block elements are inner transition elements.
(iv)	(b) Number of unpaired electrons	Greater the number of unpaired electrons, greater the binding energy.
(v)	(c) Cr, Mo,W	Group VI B elements are typical transition elements.
(vi)	(c) $[Pt\,Cl(NO_2)(NH_3)_4]SO_4$	Pt is central metal atom and Cl, NO_2 and NH_3 are ligands.
(vii)	(c) Cast iron > Steel > wrought iron	Wrought iron is the purest form of iron having least percentage of carbon.
(viii)	(a) d – d transitions of electrons	When d-orbitals are involved in bonding, they split up into two energy levels, one set has a higher energy than the other. Electrons residing in low energy d-orbitals absorb a part of visible light and jump to high energy d-orbitals.
(ix)	(d) 6	Cl, NO_2 and NH_3 are monodentate ligands so donate one electron pair to Pt each. Hence, coordination number of Pt is 6.
(x)	(d) 58	It includes both d and f – block elements.

Previous Boards MCQ's

1. The central metal atom or ion along with ligands is called a (D.G Khan 08)
(a) Coordination number (b) Coordination sphere (c) Chelates (d) None of these

2. Following is non-typical transition element. Atomic numbers are within parenthesis (D.G Khan 09)
(a) Cd (48) (b) Mo (42) (c) Cr (24) (d) Fe (26)

3. The non-typical transition element is (D.G Khan 10, Srg 09, Fsd 12, Fsd Sup 10, Grw 10)
(a) Cr (b) Mn (c) Zn (d) Fe

4. Formula of chromyl chloride is (Rwp 08)
(a) Cr_2OCl_2 (b) CrO_2Cl_2 (c) Cr_2OCl_3 (d) $CrOCl_2$

5. Group VI-B of transition element contains (Rwp 10, Grw 09, Lhr 08)
(a) Zn, Cd, Hg (b) Fe, Ru, Os (c) Cr, Mo, W (d) Mn, Te, Re

6. f-block elements are also called (Fsd 08)
(a) Non typical transition elements (b) Outer transition elements
(c) Inner transition elements (d) None of these

7. Which is a typical transition metal (Fsd 09)
(a) Se (b) Y (c) Ra (d) Co

8. The colour of transition Metal complexes is due to (Fsd 10, Lhr 12)
(a) d-d transition of electron (b) Ionization
(c) Paramagnetic nature of transition elements (d) loss of s-electrons

9. The co-ordination number of the transition element in $[Co(NO_2)_3(NH_3)_3]$ (Sgr 10)
(a) 1 (b) 3 (c) 6 (d) 7

10. The percentage of carbon in different types of iron products in the order of (Grw 08)
(a) Cast iron > wrought iron > steel (b) Wrought iron > steel > cast iron
(c) Cast iron > steel > wrought iron (d) Cast iron = steel > wrought iron

11. Which metal is used in the thermite process because of its activity (Lhr 09)
(a) Iron (b) Copper (c) Aluminium (d) Zinc

12. Oxidation number of Fe in $K_4[Fe(CN)_6]$ is (Lhr 09)
(a) +4 (b) +2 (c) +6 (d) –4

13. Coordination number of Pt in $[PtCl(NO_2)(NH_3)_4]^{2+}$ is (Lhr 10)
(a) 12 (b) 4 (c) 1 (d) 6

14. Following property of transition elements does not vary with a regular pattern (Lhr 11)
(a) Binding energy (b) Melting point (c) Covalent radius (d) Cationic radius

15. Mild steel contains carbon (Lhr 12)
(a) 0.1 to 0.2% (b) 0.2 to 0.7% (c) 0.2 to 0.6% (d) 0.1 to 0.6 %

16. Percentage of carbon in steel is (Lhr 12)
(a) 0.25 to 2.5% (b) 0.12 to 0.20% (c) 1.2 to 4.5% (d) 2.0 to 4.5%

Qarta Academy

Entry Test MCQ's

1. Brass, bronze and German silver have one metal in common. This is
(a) Zn (b) Cu (c) Fe (d) Al
2. Which of the following pairs of ions is colourless?
(a) Ti^{4+}, Cu^{2+} (b) Co^{2+}, Fe^{3+} (c) Sc^{3+}, Zn^{2+} (d) Ni^{2+}, V^{3+}
3. Which of the following elements does not belong to first transition series?
(a) Fe (b) Cu (c) V (d) Ag
4. The property, which is not characteristic of transition metals, is
(a) Variable oxidation states (b) Tendency to form complexes
(c) Formation of coloured compounds (d) Natural radioactivity
5. Among the following outermost configuration of transition metals, which shows the highest oxidation state
(a) $3d^3 4s^2$ (b) $3d^5 4s^2$ (c) $3d^2 4s^1$ (d) $3d^0 4s^2$
6. Which of the following ions has smallest radius?
(a) Mn^{2+} (b) Ti^{2+} (c) Ni^{2+} (d) V^{2+}
7. The yellow colour of chromates changes to orange on acidification due to formation of
(a) Cr^{3+} (b) $Cr_2O_7^{2-}$ (c) Cr_2O_3 (d) CrO_4
8. The electrons present in the penultimate orbit of coinage metal atoms are
(a) 8 (b) 18 (c) 2 (d) 32
9. The formula of haematite is
(a) Fe_2O_3 (b) $FeCO_3$ (c) Fe_3O_4 (d) FeS_2
10. In the extraction of iron in the blast furnace, the reducing agent for the ore is
(a) Carbon (b) Carbon dioxide (c) Carbon monoxide (d) Silica
11. Acidified potassium permanganate is decolorized by
(a) White vitriol (b) Laughing gas (c) Bleaching powder (d) Mohr's salt
12. Bessemer converter is used in the manufacture of
(a) Pig iron (b) Wrought iron (c) Steel (d) Cast iron
13. Iron is protected by coating it with a thin layer of
(a) Cu (b) Pb (c) Zn (D) Mg
14. An explosion takes place when conc. H_2SO_4 is added to $KMnO_4$. Which of the following is formed?
(a) Mn_2O_7 (b) $MnSO_4$ (c) MnO_2 (d) Mn_2O_3
15. What is the shape of $Fe(CO)_5$ molecule?
(a) Tetrahedral (b) Trigonal bipyramidal (c) Octahedral (d) Square pyramidal
16. Lanthanides and actinides resemble in
(a) Electronic configuration (b) Ionization state (c) Oxidation state (d) Formation of complexes
17. A complex compound in which the oxidation number of metal is zero
(a) $[Ni(CO)_4]$ (b) $K_3[Fe(CN)_6]$ (c) $[Pt(NH_3)_4]Cl_2$ (d) $K_3[Fe(CN)_6]$
18. All ligands are
(a) Lewis acids (b) Neutral (c) Lewis bases (d) None of these
19. Complexes with bidentate ligands are called
(a) ligands (b) Complexes (c) Chelates (d) None of these
20. The percentage of carbon in medium carbon steel is
(a) 0.7-1.5 (b) 0.1-0.2 (c) 0.2-0.7 (d) 1.6-2.00

Additional MCQ's

1. The colour of potassium permanganate crystal is
(a) Black (b) Yellow (c) Dark purple (d) Green
2. Which statement about the complex $K_2[Cu(CN)_4]$ is correct
(a) Its name is potassium tetracyanocopper (II)
(b) In this complex coordination number of central atom is two
(c) Ligands attached to central atom are positive
(d) Central metal atom is present in negative sphere
3. Painting prevent the corrosion of metal due to
(a) The formation of protective layer (b) The formation of matel oxide protective layer
(c) The formation of metal paint complex (d) The formation of highly reactive layer of hydroxide
4. Stainless steel is
(a) Compound (b) An element (c) Mixture (d) 100% pure Iron
5. Puddling furnace or reverberatory furnace is used to manufacture
(a) Stainless steel from pig iron (b) Wrought iron from cast iron
(c) Stain less steel from wrought iron (d) High steel from medium steel
6. Which furnace is used to prepare steel:
(a) Blast furnace (b) Puddling furnace (c) Bessemer furnace (d) None of these
7. Which of the following ions is readily able to donate electrons?
(a) Al^{3+} (b) Fe^{2+} (c) Zn^{2+} (d) Mg^{2+}
8. Which one of the following materials cannot be used for protective coating of objects made of iron.
(a) Grease (b) Zinc (c) Sn (d) Mg
9. Which species does not act as ligand in the formation of complexes:
(a) N_2H_4 (b) OH (c) Cl (d) NH_4
10. Which substance is not charged in open hearth furnce for manufacture of steel.
(a) Cast iron (b) Steel scrap (c) Quick lime (d) Caustic soda
11. Which one of the following is bidentate ligand?
(a) Cyano (b) Chloro (c) Acetato (d) Oxalato
12. In bessemer converter, air bubbles from steel are removed by adding small amount of
(a) Carbon (b) Silicon (c) Aluminium (d) Carbon dioxide
13. The aqueous solution of which substance is green in colour
(a) K_2CrO_4 (b) $K_2Cr_2O_7$ (c) $KMnO_4$ (d) K_2MnO_4
14. Galvanized iron is protected by a thin layer of:
(a) Cr (b) Zn (c) Sn (d) Pb
15. Cr is in +6 oxidation state in
(a) CrO_4^{-2} (b) $Cr_2O_7^{2-}$ (c) CrO_2Cl_2 (d) All of these
16. In acidic medium, potassium dichromate acts as:
(a) Oxidizing agent (b) Reducing agent (c) Acid (d) Base
17. The melting and boiling points of transition elements are:
(a) Low (b) normal (c) Very high (d) very low
18. EDTA is a _____ ligand:
(a) Monodentate (b) Bidentate (c) Polydentate (d) None of these
19. When some ligands are attached to the central metal atom or ion it is called

bhatti Academy

(a) Double Salt (b) Common salt (c) Complex (d) None

20. Reduction of Mn^{+7} in strongly basic solution produces:
(a) Mn_2O_4 (b) MnO_2 (c) MnO_4^{2-} (d) Mn^{2+}

21. The empty spaces between atoms of transition metals in their crystal lattices are called
(a) Interstices (b) Vacant spaces (c) Valance spaces (d) All of these

22. Which one of the following ions is coloured
(a) Al^{3+} (b) K^+ (c) Fe^{3+} (d) B^{3+}

23. Which of the following elements is ferromagnetic
(a) Carbon (b) Calcium (c) Cobalt (d) Pb

24. Bessemer converters are used to get:
(a) Aluminium (b) Steel (c) Chromium (d) Sodium

25. The corrosion of metals can be prevented by:
(a) Alloying and removed of strains (b) Paint coatings
(c) Grease and oil coatings (d) All of the above

26. Potassium chromate is:
(a) Yellow crystalline solid (b) Red crystalline solid
(c) Dark purple crystalline solid (d) Blue crystalline solid

ANSWERS TO MCQ'S

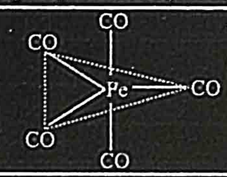
Previous Boards MCQ's

C

Q.No.	Answer	Reason
1.	(b) Coordination sphere	$[Fe(CO)_5]$ is neutral coordination sphere, $[Co(NH_3)_6]^{+2}$ is cationic cordination sphere and $[Cu(CN)_4]^{-2}$ is anionic coordination sphere.
2.	(a) Cd (48)	Cd is non-typical transition element, because it has no partially filled d-orbital either as element or in any of its oxidation state.
3.	(c) Zn	Zn is non–typical transition element, because it has no partially filled d-orbital either as element or in any of its oxidation state.
4.	(b) CrO_2Cl_2	Chromyl chloride is brownish gas. Chromyl chloride test is confirmatory test for chloride radical.
5.	(c) Cr, Mo, W	Group VI B elements are typical transition elements.
6.	(c) Inner transition elements	f-block elements are inner transition elements.
7.	(d) Co	Sc and Y are non-typical transition elements & Ra is not a transition element.
8.	(a) d-d transition of electrons	d – orbitals, taking part in binding, spilt into two energy levels, electrons from low energy level absorbs a part of visible light and jump to high energy level.
9.	(c) 6	Both NO_2 and NH_3 are monodentate ligands, so coordination number of Co is 6.
10.	(c) Cast iron > Steel > Wrought iron	Wrought iron is purest form of iron having least percentage of carbon.
11.	(c) Aluminum	Aluminum removes air bubbles from metals.
12.	(b) +2	$\overset{(+1)}{K_4}\left[\overset{+2}{Fe}\overset{(-1)6}{CN}\right]$
13.	(d) 6	Cl, NO_2 and NH_3 are monodentate ligands.

14.	(d) Cationic radius	Cationic radius of transition elements vary so irregularly that there is no trend given to them.
15.	(a) 0.1 to 0.2%	Mild steel is fairly soft, malleable and ductile. It can be forged.
16.	(a) 0.25 to 2.5 %	Steel is an alloy of iron containing carbon, P, S, Si and Mn.

Entry Test MCQ's

1.	(b) Cu	Brass: Cu – 60 – 80% : Zn 40 – 20% Bronze: Cu 75 – 90 % : Sn 25 – 10% German Silver: Cu 56% : Zn 24% , Ni20%
2.	(c) Sc^{+3}, Zn^{+2}	Sc^{+3} and Zn^{+2} have no partially filled d-orbitals so they show no colour.
3.	(d) Ag	Ag belongs to 2nd transition series.
4.	(d) Natural Radioactivity	All transition metals are not radioactive.
5.	(b) $3d^5\,4s^2$	$3d^5 4s^2$ is the valence shell electronic configuration of Mn which shows the highest oxidation state.
6.	(c) Ni^{2+}	Ni^{2+} has smallest size because cationic radius decreases across the period.
7.	(b) $Cr_2O_7^{-2}$	$2CrO_4^{-2} + 2H^+ \rightleftharpoons Cr_2O_7^{2-} + H_2O$ On acidification, the chromates are change to dichromates which have orange colour.
8.	(b) 18	Cu is coinage metal. Penultimate orbit has 18 electrons.
9.	(c) Fe_2O_3	Magnetite (Fe_3O_4), haematite (Fe_2O_3), limonite ($Fe_2O_3.3H_2O$)
10.	(a) Carbon monoxide	CO acts as reducing agent, reacts with oxygen and forms carbon dioxide.
11.	(d) Mohr's salt	$FeSO_4.(NH_4)_2SO_4.6H_2O$
12.	(c) Steel	The furnace used in this process is Bessemer's converter which is a pear shaped vessel made of steel plates.
13.	(c) Zn	In electrochemical series, Zn lies above the Fe. After galvanizing, when protective Zn layer is damaged, a galvanic cell is formed. Zn decays and Fe remains intact. This is called sacrificial corrosion.
14.	(b) $MnSO_4$	$2KMnO_4 + 3H_2SO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5[O]$
15.	(b) Trigonal bipyramidal	
16.	(d) Formation of Complexes	Lanthanides and Actinides are transition elements. It is the characteristic of transition elements to form complexes.
17.	(a) $[Ni(CO)_4]$	CO is neutral ligand so oxidation state of Ni is zero.
18.	(c) Lewis bases	Ligands donate electron pairs to central metal atom, and a specie which donates electron is a lewis base.
19.	(c) Chelates	Dioxalato palatinate (II) ion is an example of chelate.
20.	(c) 0.2 – 0.7	It is harder than mild steel.

Khattak Academy

Additional MCQ's

1.	(c) Dark Purple	$KMnO_4$ is powerful oxidizing agent of dark purple colour.
2.	(c) Ligands attached to central metal atom are positive.	In $K_3[Cu(CN)_4]$, CN^- is ligand having negative charge
3.	(a) The formation of protective layer	it protects the metal surface from coming in direct contact with the surrounding.
4.	(c) Mixture	Stainless steel has special characteristics due to many elements present in it.
5.	(b) Wrought iron from cast iron	Wrought iron is manufactured from cast iron by heating it in a special type of furnace called pudding furnace.
6.	(c) Bessemer furnace	In this furnace, steel is prepared using cast iron only.
7.	(b) Fe^{+2}	Fe^{+2} readily donates electron to from Fe^{+3}.
8.	(c) Sn	Zn and Mg have less E°_{red} value than Fe. So they can be used for protective coating of objects made of iron. Grease can also be used to protect iron.
9.	(d) NH_4^+	Ligand is neutral or negatively charged and cationic ligand is not possible.
10.	(d) Caustic soda	Cast iron, steel scrap and quick lime is charged into the furnace.
11.	(d) Oxalato	Oxalato donates two pairs of electrons to central metal atom.
12.	(c) Aluminum	Aluminum can react with both oxygen and nitrogen due to which it is used to remove air bubbles.
13.	(d) K_2MnO_4	K_2MnO_4 is green in colour and used to prepare $KMnO_4$.
14.	(b) Zn	Zn decays but Fe remains intact so it is saerificial corrosion.
15.	(b) $Cr_2O_7^{-2}$	$[Cr_2O_7]^{-2}$
16.	(a) Oxidizing agent	Potassium dichromate oxidizes $FeSO_4$ in acidic medium
17.	(c) Very high.	Melting and boiling points of transition elements are very high due to strong binding forces present in it.
18.	(c) Polydentate	EDTA is ethylene diammine tetraacetate.
19.	(c) Complex	e.g., $[Fe(CO)_5]$ is a complex
20.	(c) MnO_4^{-2}	$4KMnO_4 + 4KOH \longrightarrow 4K_2MnO_4 + 2H_2O + O_2$
21.	(a) Interstices	These are also called crevices or voids.
22.	(c) Fe^{3+}	Fe^{3+} has partially filled d-orbital so it is coloured.
23.	(c) Cobalt	Cobalt is ferromagnetic due to presence of unpaired electrons in d-orbital.
24.	(b) Steel	Pear shaped vessel used to manufacture steel.
25.	(d) All of above	Corrosion can be prevented by all the above methods.
26.	(a) Yellow crystalline solid	K_2CrO_4 is a powerful oxidizing agent.

Short Answers Questions

1. Explain the following terms giving examples.

(a) Ligands (b) Coordination sphere (c) Coordination number
(d) Central metal atom (e) Chelates

Ans. **(a) Ligands:**

"The atoms, ions or neutral molecules, which surrounds the central metal ion and donate electron pairs to it are called ligands".

- It is also called Lewis base.
- It may be anions or neutral molecule.

Examples:

$K_4[Fe(CN)_6]$

In this complex compound CN^- (cyanide ion) is a ligand.

$[Ag(NH_3)_2]Cl$

In this complex compound NH_3 (ammine) is a ligand.

(b) Coordination Sphere:

"The central metal atom or ion along with ligands is called coordination sphere".

- It is usually placed in square brackets.
- It may be anionic, cationic or neutral.

Examples:

$K_4[Fe(CN)_6]$

In this complex compound, $[Fe(CN)_6]^{-4}$ is the anionic coordination sphere.

(2) $[Cu(NH_3)_4]SO_4$

In this complex compound, $[Cu(NH_3)_4]^{+2}$ is the cationic coordination sphere.

(3) $[Ni(CO)_4]$

In this complex compound, $[Ni(CO)_4]^0$ is the neutral coordination sphere.

(c) Coordination Number:

"The number of lone pair of electrons provided by the ligands to the central metal atom or ion is called the coordination number of the central metal atom or ion".

Examples:

(1) $K_4[Fe(CN)_6]$

In this complex compound, the coordination number of iron is 6.

(2) $[Cu(NH_3)_4]SO_4$

In this complex compound, the coordination number of copper is 4.

(d) Central Metal Ion:

"A metal atom or ion usually a transition element surrounded by a number of ligands is called central metal atom or ion"

Examples:

(1) $K_4[Fe(CN)_6]$.
Fe^{+2} is the central metal ion.

(2) $[Ag(NH_3)_2]Cl$
Ag^{+1} is the central metal ion.

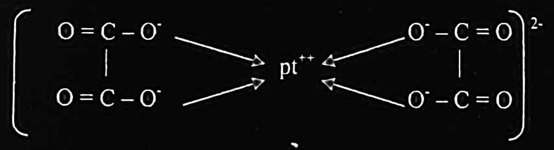
(3) $[Cu(NH_3)_4]SO_4$
Cu^{+2} is a central metal ion.

bmattia Academy

Chelates:

"When all the donor atoms of a polydentate ligand get coordinated with the same metal ion, a complex compound is formed which contains one or more rings in its structure and is called chelates".

Examples:



$[Pt(C_2O_4)_2]^{2-}$

Dioxalato-platinate (II) ion

When two oxalate ligands $C_2O_4^{2-}$ (bidentate ligand) get coordinated with Pt^{+2} ion, diaxolato palatinate (II) ion is formed. In this we observe two five membered rings.

2. Give systematic names to following complexes.

(a) $[Fe(CO)_5]$

Ans. Pentacarbonyl iron(o).

(b) $[CO(NH_3)_6]Cl_3$

Ans. Hexa-ammine cobalt (III) chloride

(c) $[Fe(H_2O)_6]^{2+}$

Ans. Hexaaqua iron (II) ion

(d) $Na_3[CoF_6]$

Ans. Sodium hexaflourocobalate (III)

(e) $K_2[Cu(CN)_4]$

Ans. Potassium tetracyano Cupparate (II)

(f) $K_2[Pt\ Cl_6]$

Ans. Potassium hexachloropalatinate (IV)

(g) $[Pt(OH)_2(NH_3)_4]SO_4$

Ans. Tetra-ammine dihydroxoplatinum (IV) sulphate.

(h) $[Cr(OH)_3(H_2O)_3]$

Ans. Triaquatrihydroxochromium (III)

3. Why transition elements are called so?

Ans. **Transition elements:**

The elements of d-block and f-block are called transition elements because they are located between s and p-block elements and their properties are in transition between the metallic elements of s-block and non-metallic elements of p-block.

4. What are non-typical transition elements? In which respect they differ from those of typical transition elements?

Ans. **Non-typical transition elements:**

The elements (Zn, Cd, Hg) of group IIB and (Sc, Y, La) of group IIIB are called non-typical transition elements.

Group IIB Elements

According to definition of transition elements, Zn, Cd and Hg should not be placed with d-block elements because they do not have a partially filled d-orbital either as elements or in any of their oxidation state.

Group IIIB elements:

They have one electron in the d-sub-shell of their atoms. But in compounds, they mostly occur as the tripositive ions (Sc^{+3}, Y^{+3}, La^{+3}), having no d-electron. In this way they exhibit the properties of main group elements.

Properties differing from typical transition elements:

(i) These elements (Zn, Cd, Hg) are diamagnetic.
(ii) They do not show variable oxidation state.
(iii) Most of their compounds are white.

5. What are interstitial compounds? Write down their different characteristics.

Ans. **Interstitial compounds.**

When small non-metal atoms like H, B, C, N enter the interstices of transition metals and impart useful features to them, they are called interstitial compounds.

Examples:

T_iC, T_iH, Fe_3H etc

(i) These are non-stoichiometric compounds.
(ii) They are neither typically ionic nor covalent.
(iii) They have some properties different from those of transition metals. e.g. hardness, melting points, chemical properties etc.

6. Give some examples of Neutral and Anionic lingands.

Ans.

LIGANDS			
Neutral Ligands		Anionic Ligands	
1.	NH_3 (Ammine)	1.	Cl^- (Chloro), F^- (Fluoro), Br^- (Bromo), I^- (Iodo)
2.	H_2O (Aqua)	2.	OH^- (Hydroxo)
3.	CO (Carbonyl)	3.	CN^- Cyano
4.	NO (Nitrosyl)	4.	O^{2-} (Oxido)
5.	PH_3 (Phosphine)	5.	CO_3^{2-} (Carbonato)
6.	CH_3NH_2 (Methylamine)	6.	$(C_2O_4)^{2-}$ (Oxalato)

7. Differentiate paramagnetic and diamagnetic substances.

Ans.

	Paramagnetic substances		Diamagnetic substances
1.	The substances which are weakly attracted by a strong magnetic field are called paramagnetic substances.	1.	The substances which are weakly repelled by a strong magnetic field are called diamagnetic substances.
2.	Elements like Cr, Mn, Fe, Co are paramagnetic	2.	Group II-B elements (Zn. Cd, Hg) are diamagnetic.

8. How do you compare the cast iron, wrought iron and steel with respect to the %age of carbon?

Ans.

Substance	%age of carbon
Cast or pig iron	2.5 to 4.5%
Steel	0.25 to 2.5%
Wrought iron	0.12 to 0.25%

9. How dichromate ions are converted into Chromate ions?

Ans. In an aqueous solution, CrO_4^{2-} and $Cr_2O_7^{2-}$ are exists in equilibrium.

$$2CrO_4^{2-} + 2H^+ \rightleftharpoons Cr_2O_7^{2-} + H_2O$$

Khatti Academy

When an alkali is added in this sol., the OH^- ions from the alkali Binds the H^+ ions in solution to form H_2O. Thus according to le – chatelier's principle when conc. of reactants decrease then the reaction / equilibrium will shift in the backward direction so in this way, the dichromate ion $Cr_2O_7^{2-}$ can be converted into chromate ion $Cr\ O_4^{2-}$

10. How Chromate ions are converted into dichromate ions?

Ans. In an equeous solution, CrO_4^{2-} and Cr_2O^{-2} ion exist in equilibrium.

$$2CrO_4^{2-} + H \rightleftharpoons Cr_2O^{-2} + H_2O$$

When an acid is added in such a solution then the H^+ ions from the acid increases in its conc. According to Le-chatelier's principle, if the concentration of reactants increased at equilibrium stage this will disturbs the position and the reaction is shifted in forward direction. So in this way, CrO_4^{2-} ions are converted into dichromate ions. Cr_2O^{-2}

11. Why does damaged tin plated iron gets. rusted quickly.

Ans. **Tin plating or coating iron with tin (cathode coating)**

The process of tin plating consists of dipping the clean sheet of iron in a bath of molten tin and then passing it through hot pairs of rollers. Such plates are used in a manufacture of tin canes, oil containers and other similar articles.

Tin itself is a very stable and protects the metals effectively as long as its coating on the iron is intact.

If the protective coating is damaged, then iron comes into contact with moisture. A Galvanic cell is established in which tin acts as a cathode and iron as an anode. The electrons flow from iron to tin, where they discharge H^+ ions, leaving behind OH^- in the solution. These OH^- ions react with iron and forming $Fe(OH)_3$, which dissolves rapidly in water.

$$Fe^{3+} + 3OH^- \longrightarrow Fe(OH)_3$$

From this, it can be concluded that plated iron gets rust more rapidly when the protective coating is damaged than the non – plated iron.

12. Under what conditions does aluminium corrode?

Ans. When an active metal Al comes in contact with less active metals like Zn, Cu, Fe, Sn (i.e. having greater reduction potential than Al) a Galvanic cell is established in which Al acts as an anode while metals like Zn, Fe etc act as cathode. In this process, active metal (Al) corrodes rapidly while the others remain intact.

On the other hand, the main condition of rapid corrosion of Al is when the protected layer is damaged and the metal comes in direct contact with water. Besides dissolving the compounds, water also allow the corrosion to penetrate further into the metal and promotes the electro chemical process.

13. How does the process of galvanizing protect iron from rusting.

Ans. **Galvanizing protect iron from rusting:**

When a clean sheet of iron is dipped in a zinc chloride bath and heated, the iron sheet is then removed, rolled into Zn bath and air cooled. This process is called Galvanizing or Zn coating.

If the sheet of Zn is damaged, a galvanic cell is established in the presence of moisture. Iron serves as a cathode and zinc as an anode. Electrons flow from Zn to iron, so Zn decays and Fe remains intact.

$$Fe^{+2} + Zn \longrightarrow Zn^{+2} + Fe$$

This is called sacrificial corrosion. It helps protecting iron from corrosion.

14. "Dichromates are very powerful oxidizing agents" prove the truth of this statement by giving examples.

Ans. **Dichromates is a powerful oxidizing agents:**

Dichoromates are very powerful oxidizing agents. It oxidation is carried out in acid solution. In this process hexavalent chromium ion is reduced to trivalent chromium ion.

a) $K_2Cr_2O_7 + 3H_2S + 4H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3S$

b) $K_2Cr_2O_7 + 7H_2SO_4 + 6FeSO_4 \rightarrow 3Fe_2(SO_4)_3 + Cr_2(SO_4)_3 + K_2SO_4 + 7H_2O$

c) $K_2Cr_2O_7 + 7H_2SO_4 + 6KI \rightarrow 4K_2SO_4 + Cr_2(SO_4)_3 + 3I_2 + 7H_2O$

d) $K_2Cr_2O_7 + 4NaCl + 6H_2SO_4 \rightarrow 2KHSO_4 + 4NaHSO_4 + 3H_2O + 2CrO_2Cl_2$

(Chromyl Chloride)

In the above examples, potassium dichromate oxidizes H_2S, $FeSO_4$, KI and NaCl into S, $Fe_2(SO_4)_3$, I_2 and CrO_2Cl_2 respectively in the presence of H_2SO_4.

15. Potassium permanganate is a powerful oxidizing agent. Prove with examples.

Ans. **Potassium permanganate, ($KMnO_4$) is a powerful oxidizing agent:**

Its oxidation is usually carried out in an acid solution.

$KMnO_4$ oxidises H_2S, $FeSO_4$, $H_2C_2O_4$ (oxalic acid) and KOH into S, $Fe_2(SO_4)_3$, CO_2 and O_2 respectively

- $2KMnO_4 + 3H_2SO_4 + 5H_2S \rightarrow K_2SO_4 + 2MnSO_4 + 5S + 8H_2O$
- $2KMnO_4 + 8H_2SO_4 + 10FeSO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$
- $2KMnO_4 + 3H_2SO_4 + 5H_2C_2O_4 \rightarrow K_2SO_4 + 2MnSO_4 + 10CO_2 + 8H_2O$
- $4KMnO_4 + 4KOH \rightarrow 4K_2MnO_4 + O_2 + 2H_2O$

16. Which one of Fe^{2+} and Fe^{3+} ions is more paramagnetic and why?

Ans. Fe^{3+} is more paramagnetic than Fe^{2+}. As Fe^{3+} consists of five unpaired electrons while Fe^{2+} possesses four unpaired electrons.

17. What happens when Green vitriol is strongly heated?

Ans. When Green vitriol is heated strongly, a mixture of gases consisting SO_2 and SO_3 is evolved and a red residue, Fe_2O_3 is formed.

$$[FeSO_4.7H_2O \longrightarrow FeSO_4 + 7H_2O]x2$$

$$2FeSO_4 \longrightarrow Fe_2O_3 + SO_2 + SO_3$$

18. Zinc becomes dull in moist air.

Ans. When zinc is exposed to moist air, the surface is affected with the formation of a film of basic zinc carbonate on it. Due to this zinc becomes dull.

- $[2Zn + 2H_2O + O_2 \longrightarrow 2Zn(OH)_2]x2$

$$Zn(OH)_2 + CO_2 \longrightarrow ZnCO_3 + H_2O$$

$$ZnCO_3 + 3Zn(OH)_2 \longrightarrow ZnCO_3 + 3Zn(OH)_2$$

$$4Zn + 3H_2O + CO_2 + 2O_2 \longrightarrow ZnCO_3 + 3Zn(OH)_2$$

19. Yellow coloured aqueous solution of sodium chromate changes to orange red when CO_2 under pressure is passed.

Ans. Yellow coloured aqueous solution of sodium chromate changes to orange red on passing CO_2 as H^+ ions are formed which are responsible for conversion of chromate into dichromate.

$$CO_2 + H_2O \rightleftharpoons H^+ + HCO_3^-$$

$$2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O^{2-} + H_2O$$

Yellow Orange red

20. Green solution of potassium manganate, K_2MnO_4 turns purple when CO_2 is circulated.

Ans. CO_2 gives H^+ ions which are responsible for conversion of manganate (green) to permanganate (purple).

$$CO_2 + H_2O \rightleftharpoons H^+ + HCO_3^-$$

$$3MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + 2H_2O$$

Green Purple

bhattiacademy.com

21. The melting and boiling points of Zn, Cd and Hg are low: Why?

Ans. In Zn, Cd and Hg, the (n -1) d-orbitals are filled to their maximum capacity. These d-electrons do not take part in metallic bonding. Thus, metallic bonding is weak in Zn, Cd and Hg. That is why, they have low melting and boiling points.

22. A transition metal exhibits highest oxidation state in oxides and fluorides.

Ans. A metal exhibits higher oxidation states in oxides and fluorides as oxygen and fluorine are highly electronegative elements and small in size, i.e., act as strong oxidizing agents. For example, chromium shows an oxidation state of +6 in CrF_6 and osmium shows oxidation state of +8 in OsO_4.

23. $CuSO_4$ is paramagnetic while $ZnSO_4$ is diamagnetic

Ans. In $CuSO_4$, Cu^{2+} ion has $3d^9$ configuration i.e., one unpaired electron while Zn^{2+} ions has $3d^{10}$ configuration i.e., all orbitals doubly occupied and no unpaired electron is available.

****

Available in Market

ATP
CHEMISTRY,
PHYSICS, BIOLOGY
11th and 12th

CHAPTER 7

FUNDAMENTAL PRINCIPLES OF ORGANIC CHEMISTRY

Solved Objective Exercise

Q1. Fill in the blanks.

(i) Organic compounds having, same molecular formula but different _____ are called isomers.
(ii) The state of hybridization of carbon atom in _____ is sp^2.
(iii) Alkenes show _____ due to restricted rotation around a carbon – carbon double bond.
(iv) Heating an organic compound in the absence of oxygen and in the presence of _____ as a catalyst is called cracking.
(v) A group of atoms which confers characteristic properties to an organic compound is called _____.
(vi) 2-Butene is _____ of 1--Butene.
(vii) Carbonyl functional group is present in both _____ and ketones.
(viii) A heterocyclic compound contains an atom other than _____ in its ring.
(ix) The quality of gasoline can be checked by finding out its _____.
(x) A carboxylic acid contains _____ as a functional group.

Answer Key

(i)	Structural formula	(ii)	Ethene
(iii)	Geometric isomerism	(iv)	$SiO_2 + Al_2O_3$
(v)	Functional group	(vi)	Positional isomer
(vii)	Aldehydes	(viii)	Carbon
(ix)	Octane number	(x)	–COOH

Q2. Indicate True or false.

(i) There are three possible isomers for pentane.
(ii) Alkynes do not show the phenomenon of cis-trans isomerism.
(iii) Organic compounds can not be synthesized from inorganic compounds.
(iv) All closed chain compounds are aromatic in nature.
(v) The functional group present in amides is called an amino group.
(vi) Government of Pakistan is trying to use coal for power generation.
(vii) Crude petroleum is subjected to fractional sublimation in order to separate it into different fractions.
(viii) A bond between carbon and hydrogen serves as a functional group for alkanes.
(ix) o-Nitrotoluene and p-nitrotoluene are the examples of functional group isomerism.
(x) Almost all the chemical reactions taking place in our body are inorganic in nature.

Answer Key

(i)	True	(ii)	True	(iii)	False	(iv)	False	(v)	False
(vi)	True	(vii)	False	(viii)	False	(ix)	False	(x)	False

bhattiAcademy

Q3. Multiple Choice Questions. Encircle the correct answer.

(i) The state of hybridization of carbon atom in methane is:
(a) sp^3 (b) sp^2 (c) sp (d) dsp^2

(ii) In t-butyl alcohol, the tertiary carbon is bonded to :
(a) two hydrogen atoms (b) three hydrogen atoms
(c) one hydrogen atom (d) no hydrogen atom

(iii) Which set of hybrid orbitals has planar triangular shape?
(a) sp^3 (b) sp (c) sp^2 (d) dsp^2

(iv) The chemist who synthesized urea from ammonium cyanate was:
(a) Berzelius (b) Kolbe (c) Wohler (d) Lavoisier

(v) Linear shape is associated with which set of hybrid orbitals?
(a) sp (b) sp^2 (c) sp^3 (d) dsp^2

(vi) A double bond consists of:
(a) two sigma bonds (b) one sigma and one pi bond
(c) one sigma and two pi bonds (d) two pi bonds

(vii) Ethers show the phenomena of:
(a) position isomersim (b) functional group isomerism
(c) metamerism (d) cis-trans isomerism

(viii) Select from the following the one which is alcohol :
(a) CH_3-CH_2-OH (b) CH_3-O-CH_3
(c) CH_3COOH (d) CH_3-CH_2-Br

Solved Exercise MCQ's

Q.No	Answers	Reasons
(i)	(a) sp^3	Central atom (C) is attached with four H-atoms.
(ii)	(d) no hydrogen atom	Tertiary carbon is attached with no H-atom.
(iii)	(c) sp^2	Angle b/w each orbital is 120°.
(iv)	(c) Wohler	He was a German scientist who rejected vital force theory.
(v)	(a) sp	180° sp — sp
(vi)	(b) one sigma and one pi bond	In σ – bond, electronic density lies on the internuclear axis and in π – bond, it lies above and below internuclear axis.
(vii)	(c) metamerism	$CH_3 – CH_2 – O – CH_2 – CH_3$; $CH_3 – CH_2 – CH_2 – O – CH_3$ are metamers.
(viii)	(a) CH_2-CH_2-OH	Alcohol has – OH group as functional group

Previous Boards MCQ's

1. The crude petroleum is separated in fractions by: (D.G Khan 2008)
(a) filtration (b) fractional distillation (c) steam distillation (d) fractional sublimation
2. Number of isomers of C_4H_{10} is: (D.G Khan 2010)
(a) 1 (b) 2 (c) 3 (d) 4
3. Which of the following compounds may exist as cis-trans isomers: (Rwp 2008)
(a) 1-butene (b) 2-butene (c) cyclopropane (d) acetone

4. Urea belongs to which class of compounds: (Rwp 2009)
(a) imides (b) amines (c) amides (d) carboxylic acid
5. Five carbon compound, pentane has number of isomers: (Fsd 2008)
(a) five (b) four (c) three (d) one
6. Linear shape is associated with which set of hybrid orbitals: (Fsd 2009)
(a) sp (b) sp^2 (c) sp^3 (d) d sp^2
7. Select one which shows cis-trans isomerism: (Fsd 2010)
(a) $Cl_2C = CCl_2$ (b) $CH_3 = CH_2$ (c) HClC = CHCl (d) $CBr_2 = CBr_2$
8. The compound that burns very smoothly in an engine having octane number of 100 is: (Fsd Sup 2010)
(a) 2,2,4-dimethylbutane (b) 2,2,4-trimethylpentane
(c) 2,2-dimethylhexane (d) 2,2,4-dimethylheptanes
9. Compounds having same molecular formula but different structural formula are called as: (Sgr 2010)
(a) polymer (b) monomer (c) isomer (c) allotropes
10. The state of hybridization of carbon atom in ethane is: (Grw 2008, Lhr 2012)
(a) sp^3 (b) sp^2 (c) sp (d) dsp^2
11. Geometric isomerism is present in: (Grw 2010)
(a) methane (b) ethane (c) propane (d) 2-butene
12. Which one of the following is not heterocyclic compound: (Lhr 2008)
(a) thiophene (b) anthracene (c) furan (d) pyrrole
13. Vital force theory was rejected by: (Lhr. 2012)
(a) G.N. Lewis (b) F. Wohler (c) Greek Philosophers (d) Scientists of 20th century
14. Pentane (C_5H_{12}) shows how many chain isomers: (Lhr. 2012)
(a) 2 (b) 3 (c) 4 (d) 5

Entry Test MCQ's

1. The first organic compound which was prepared by inorganic compound is
(a) Acetic acid (b) urea (c) Methane (d) Ethyl alcohol
2. The compound $C_4H_{10}O$ can show
(a) Metamerism (b) Functional group isomerism (c) Position isomerism (d) All of these
3. Which type of isomerism is most common among ethers
(a) Chain (b) Tautomerism (c) Position (d) Metamerism
4. Chemically similar compounds differing by a CH_2 group are called
(a) Isomers (b) Homologous (c) Isomorphous (d) None of these is correct
5. Which of the following compounds exhibits geometric isomerism
(a) 1 – Hexene (b) 3–Methyl-1-pentene (c) 2–Methyl –2–Pentene (d) 2 – Hexene
6. Which of the following alkanes has neither secondary nor tertiary hydrogen's
(a) Iso-butane (b) Pentane (c) Iso-pentane (d) Neo-pentane
7. Natural gas is composed primarily of
(a) Methane (b) n-octane (c) n-butane (d) A mixture of octanes
8. The first product obtained during fractional distillation of petroleum is
(a) Petroleum ether (b) Kerosene (c) Diesel (d) Gasoline
9. Which one of the following has the minimum boiling point
(a) n-butane (b) 1-butene (c) Isobutane (d) 1-butyne
10. Which one of the following does not have sp^2 hybridized carbon:
(a) Acetone (b) Acetonitrile (c) Acetic acid (d) Acetamide
11. Which one of the following is the heterocyclic compound
(a) Propyne (b) Phenol (c) Thiophene (d) Aniline
12. Number of isomers represented by molecular formula C_4H_{10} is
(a) 7 (b) 4 (c) 6 (d) 2

Bhatti Academy

13. Which of the following is the most stable
(a) 1-butene (b) 1-pentene (c) 2-butene (d) 2-pentene

14. Which of the following is not a mixture of hydrocarbons
(a) Candle wax (b) Vegetable oil (c) Kerosene oil (d) Paraffin oil

15. The shape of ethylene molecule is
(a) Tetrahedral (b) Planar (c) Pyramidal (d) Linear

16. _____ is added to petrol because it saves the petrol from pre-ignition
(a) Tetraethyl lead (b) Methyliodide (c) Phenol (d) Tetramethyl lead

17. Hardest form of coal is called:
(a) Peat (b) Bituminous (c) Lignite (d) Anthracite

18. Kerosene is a mixture of
(a) Aromatic hydrocarbons (b) Saturated hydrocarbons
(c) Aliphatic hydrocarbons (d) Alicyclic hydrocarbons

19. Which of the following compounds has been given an octane number of 100?
(a) n – Hexane (b) Neo – pentane (c) Iso – octane (d) Neo – octane

20. Liquid hydrocarbons is converted into a mixture of gaseous hydrocarbon by
(a) Cracking (b) Hydrolysis (c) Oxidation (d) Distillation

21. Carbon forms a large number of compounds because it has the unique property of ;
(a) Isomerism (b) Complexity of organic compounds
(c) Catenation (d) Covalent nature

22. Kerosene oil is a fraction of petroleum which is obtained by fractional distillation of petroleum. It has alkanes in the range of ;
(a) C_8H_{18} -- $C_{14}H_{30}$ (b) $C_{12}H_{26} - C_{15}H_{38}$ (c) $C_4H_{10} - C_{13}H_{28}$ (d) > $C_{18}H_{38}$

23. Which of the following type of coal has maximum %age of carbon?
(a) Peat (b) Lignite (c) Anthracite (d) Bituminous

24. -SH is a functional group of which class of organic compounds?
(a) Ether (b) Thioalcohol (c) Aldehyde (d) Carboxylic acid

25. Metamerism is shown by;
(a) Diethyl ether (b) Diethyl ketone (c) Ethylacetate (d) All of the above

26. C_2H_6O shows type of_____ structural isomerism
(a) Chain isomerism (b) Metamerism (c) Position isomerism (d) Functional group isomerism

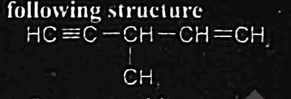
27. Which of the following statement is incorrect about petroleum?
(a) It is viscous liquid of organic compounds (b) Alkane range is from $C_1 - C_{40}$
(c) It is a renewable energy resource (d) Refined form of mineral oil

28. LPG stands for liquefied petroleum gas. it is mixture of ------ alkanes ;
(a) Methane & ethane (b) Ethane & propane (c) Propane & butane (d) Butane & pentane

29. Octane number of petroleum is increased by adding
(a) Branched chain alkanes (b) Aromatic compounds
(c) Tetraethyl lead (d) All of the above

30. The organic compound which contain ring of three or more carbon atom and resembling aliphatic compounds are called ;
(a) Aromatic compounds (b) Alicyclic compounds
(c) Heterocyclic compounds (d) Acyclic compounds

31. Consider the following structure



Correct name of compound is
(a) 2 – Methyl – 4 – Pentene – 1 – yne (b) 1 – Methyl – 4 – pentene – 2 – yne
(c) 3 – Methyl – 1– Pentene – 4 – yne (d) 4 – Methyl – 2 – pentyne – 3 –yne

32. Number of possible isomers obtained from butylchloride is
(a) 3 (b) 5 (c) 4 (d) 6

Additional MCQ's

1. Organic compounds are mainly obtained from:
(a) Coal (b) Natural gas (c) Mineral Sources (d) Fossil fuels

2. Urea is prepared from which compoud:
(a) NH_4CNO (b) NH_4NO_3 (c) $(NH_2)_2CO$ (d) $NaNO_3$

3. The property of carbon to form long chains and compounds with other atoms is due to:
(a) Oxidation (b) Reduction (c) Polarizability (d) Catenation

4. The formula of starch is:
(a) $(C_6H_{12}O_6)_n$ (b) $(C_6H_{10}O_6)_n$ (c) $(C_6H_{10}O_5)_n$ (d) $(C_{12}H_{22}O_{11})_n$

5. Organic compounds are soluble in :
(a) Water (b) Non polar solvents (c) Polar organic solvents (d) Both a and b

6. Due to bacterial action and chemical reactions on wood it is converted into:
(a) Peat (b) Lignite (c) Anthracite (d) Coal

7. Coal is a fuel and becomes a source of organic compounds when subjected to
(a) Fractional distillation (b) Destructive distillation (c) Steam distillation (d) Vacuum distillation

8. The boiling point of petroleum ether is:
(a) 60-100°C (b) 20-40°C (c) 20-60°C (d) >275°C

9. The boiling point of kerosene is:
(a) 40-220°C (b) 175-325°C (c) 170-325°C (d) 50-60°C

10. The temperature and pressure for catalytic cracking is:
(a) 500°C, 3atm (b) 700°C, 2 atm (c) 500°C, 2 atm (d) 700°C, 3 atm

11. A sharp metallic sound produced in internal combustion engine is called:
(a) Knocking (b) Cracking (c) Reforming (d) Catenation

12. Knocking greatly .....the efficiency of an engine:
(a) Increases (b) reduces (c) Decreases (d) None

13. _____ burns very smoothly in engine:
(a) iso – octane (b) 2,2,4 – Trimethylpentane
(c) iso – heptane (d) Both a and b

14. The octane number of fuel can be improved by blending it with..... :
(a) TNT (b) PVC (c) TEL (d) PVA

15. Open chain compounds are also called:
(a) Acyclic compounds (b) Alicyclic compounds
(c) Aliphatic compounds (d) Both a and c

16. Cyclohexane is an example of:
(a) Aromatic compounds (b) Alicyclic compounds
(c) Acyclic compounds (d) Aliphatic compounds

17. Which is heterocyclic compound:
(a) Methylamine (b) Pyridine (c) Nitroethane (d) Aniline

18. Aldehydes are also known as:
(a) Alkanols (b) Alkanone (c) Alkanals (d) Alkyne

19. The general formula of acid amide group is:
(a) $-NH_2$ (b) $-C \equiv N$ (c) $>C=NH$ (d) $-\overset{O}{\overset{\|}{C}}-NH_2$

20. Formyl group is present in:
(a) Aldehydes (b) Ether (c) Alcohols (d) Ester

21. Mercapto group (-SH) is present in:
(a) Ketones (b) Alcohols (c) Thiols (d) Ethers

22. Each sp^3 orbital is made up of s and p-orbitals in the ratio of :
(a) 1:4 (b) 1:3 (c) 3:1 (d) 1:2

bhattiAcademy

23. The number of isomers of a compound having 30 carbon atoms, is:
(a) Over four billion (b) Over five billion (c) 3000 (d) 30

24. 50-60°C is the melting point of:
(a) Asphalt (b) Petroleum coke (c) Paraffins (d) Gas oil

25. Asphalt is used for:
(a) Roofing (b) Paving (c) Fuel reducing agent (d) All of these

26. The fractional distillation of petroleum yields only.....gasoline:
(a) 20% (b) 20.5% (c) 30% (d) 22%

27. The ..... of products depends on conditions under which the cracking takes place:
(a) Nature (b) Purity (c) Composition (d) Working

28. _____ process is suitable for obtaining lower unsaturated hydrocarbons:
(a) Catalytic cracking (b) Thermal cracking (c) Steam cracking (d) Cracking

29. Which of the following is a byproduct of cracking of petroleum:
(a) Ethene (b) Benzene (c) Propene (d) All of them

30. Which of the following compounds are used as anti-knocking agents:
(a) Tetraethyl lead (b) Tetramethyl lead (c) None of these (d) Both a and c

31. Neo pentane is also known as
(a) 2,2 -Dimethyl propane (b) Ethylmethylbutane
(c) 2.3- Dimethyl pentane (d) Diethyl propane

32. Pyridine, Furan and pyrrole are examples of ..... compounds:
(a) Heterocyclic (b) Knocked chain (c) Homocyclic (d) Open chain

33. Whose presence imparts specific properties to a compound are called functional groups:
(a) Atom (b) Double or triple bond (c) Group of atoms (d) All of them

34. Which of the following is a derivative of water:
(a) Alcohols (b) Alkyl halides (c) Ethers (d) Both a & c

35. Anthracene has three benzene rings. The total number of carbon atoms in it is:
(a) 14 (b) 18 (c) 20 (d) None of these

36. Structure of cyclohexane is_____:
(a) Hexagonal (b) Trigonal (c) Pentagonal (d) Tetragonal

37. The compounds in which carbon atom is saturated, show the hybridization state of:
(a) sp (b) sp^2 (c) sp^3 (d) None of these

38. The compounds in which carbon is unsaturated, show the hybridization state of ____:
(a) sp^3 (b) sp^2 (c) sp (d) Both b and c

39. The state of hybridization of carbon atom in _____ is sp^2:
(a) Alkane (b) Alkene (c) Alkyne (d) None of these

40. In alkynes, there are _____ unhybridized orbitals:
(a) One (b) Three (c) Two (d) None of these

41. The simplest hydrocarbon to have structural isomerism is:
(a) Methane (b) Butane (c) Propane (d) Ethane

42. Propane has _____ isomers:
(a) Two (b) Three (c) Only five (d) None of these

43. Chain isomers have _____:
(a) Same chemical properties (b) Same physical properties
(c) Different physical properties (d) Both a and c

44. Isomerism arising due to rotation around carbon carbon double bond is called:
(a) Position isomerism (b) Metamerism (c) Cis – trans isomerism (d) Chain isomerism

45. 2 – Pentene shows phenomenon of_____:
(a) Geometric isomerism (b) Metamerism (c) Functional group isomerism (d) Tautomerism

46. Butene has_____ positional isomers
(a) Three (b) Two (c) Four (d) None of these

47. Which one has more atoms of carbon per molecule:
(a) Ethyl chloride (b) Ethyl alcohol (c) Ethyl formate (d) Ethyl amine

48. State of hybridization in ethyne is:
(a) sp^2 (b) sp (c) sp^3 (d) dsp^2

49. Which of the following compounds has one type of hybrid carbon?
(a) CH_3-CH_2-CH_2-CH_3 (b) $CH_2 = CH - CH_2 - CH_3$ (c) HC≡C-C≡CH (d) $CH_2 = CH - C \equiv CH$

50. The aliphatic compounds are also called:
(a) open chain (b) carbocyclic (c) close chain (d) heterocyclic

51. The first organic compound was synthesized in laboratory by.
(a) Wohler (b) Kolbe (c) Berzelius (d) Berthelot

52. The shape of methane molecule is.
(a) Linear (b) tetrahedral (c) triangle (d) octahedral

53. Light naphtha is a mixture of.
(a) alkane (b) alkenes (c) alkynes (d) alkyl halide

54. The quality of petroleum is determined by.
(a) iodine number (b) Hexane number (c) octane number (d) isoheptane number

55. Which one of the following general formula is for ketone
(a) R_2O (b) R – CHO (c) R_2CO (d) RCO_2H

56. In ethene molecule, the number of atoms which are present in the same plane are.
(a) 2 (b) 4 (c) 3 (d) 6

57. In which substance carbon atoms are sp – hybridized:
(a) $CH_3 - CH_3$ (b) CH ≡ CH (c) $CH_2 = CH_2$ (d) $CH_2 = CH - CH_3$

58. Which class of compounds cannot show positional isomerism?
(a) alkanes (b) alkynes (c) alkenes (d) alcohols

59. Petrol for aviation purpose must contain.
(a) straight chain hydrocarbon (b) olefins hydrocarbon
(c) Aromatic hydrocarbon (d) highly branched chain paraffin

60. Which of the following is not a mixture of hydrocarbons?
(a) candle wax (b) lubricating oils (c) Kerosene (d) vegetable oil

ANSWERS TO MCQ'S

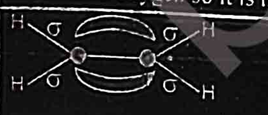
Previous Boards MCQ's

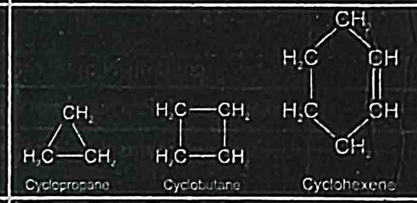
Q. No	Answer	Reason
1.	(b) Fractional distillation	Separate on the basis of difference in boiling points.
2.	(b) 2	$CH_3-CH_2-CH_2-CH_3$ (n - Butane); $CH_3-CH(CH_3)-CH_3$ (iso - Butane)
3.	(c) 2-Butene	Cis-2-Butene; Trans-2-Butene
4.	(c) Amides	$-C(=O)-NH_2$
5.	(c) Three	(i) Pentane (ii) 2-Methyl-butane (iii) 2,2-Dimethyl propane (neo-pentane)
6.	(a) sp	C is sp hybridized. (O = C = O)
7.	(c) HClC = CHCl	Due to different group attached with same C-atom.
8.	(b) 2,2,4-Trimethyl Pentane	$CH_3-(CH_2)_6-CH_3 \xrightarrow[\text{Catalyst}]{\text{Heat}} CH_3-C(CH_3)_2-CH_2-CH(CH_3)-CH_3$ (n-octane → 2,2,4-Trimethylpentane (Iso-octane))

Bhatti Academy

9.	(e) Isomer	Structural formula shows arrangement of atoms.
10.	(a) sp^3	In ethane, each C-atom is attached with four atoms further.
11.	(d) 2–Butene	Due to presence of double bond and different groups attach with same carbon.
12.	(b) anthracene	It contains only carbon and hydrogen in the structure.
13.	(b) F. Wohler	He was a German Chemist.
14.	(b) 3	(i) n – pentane (ii) 2-Methyl-butane (iii) 2,2-Dimethyl propane

Entry Test MCQ's

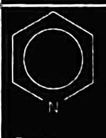
Q.No.	Answer	Reason
1.	(b) Urea	$NH_4CNO \rightleftharpoons (NH_2)_2CO$
2.	(d) All of these	(i) $C_2H_5OH, CH_3-CH_2-O-CH_2-CH_3$ (Functional group) (ii) $CH_3-O-(CH_2)_2-CH_3, CH_3-CH_2-O-CH_2-CH_3$ (Metamerism and Positional isomerism)
3.	(d) Metamerism	Different distribution of alkyl group on either side of oxygen.
4.	(b) Homologous	Consecutive members of a homologous series differ by – CH_2 group.
5.	(d) 2 – Hexene	$CH_3-CH=CH-CH_2-CH_2-CH_3$ fulfills the conditions of geometric isomerism.
6.	(d) neo-Pentane	All H-atoms are primary.
7.	(a) Methane	About 90% of it is composed of CH_4.
8.	(a) Petroleum ether	It has least boiling point among them.
9.	(c) iso-butane	Branch chain hydrocarbon have less boiling point.
10.	(b) Acetonitrile	In this compounds carbon is sp hybridized.
11.	(c) Thiophene	 Thiophene
12.	(d) 2	$CH_3-CH_2-CH_2-CH_3$ (n - Butane) $\quad CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_3$ (iso - Butane)
13.	(d) 2-Pentene	$CH_3-CH=CH-CH_2-CH_3$ or $CH_2-CH_2-CH=CH-CH_3$ It has two resonating structures, so it is most stable.
14.	(b) Vegetable oil	It contains oxygen so it is not a hydrocarbon.
15.	(b) Planar	 π – bond
16.	(a) Tetraethyl lead	$(C_2H_5)_4Pb$, It is antiknocking agent.
17.	(d) Anthracite	It has highest percentage of carbon (92 to 94 %) so hardest

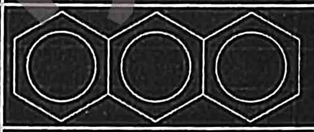
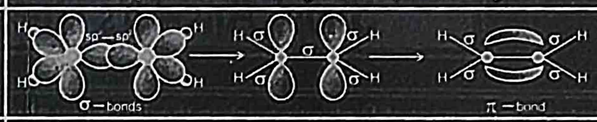
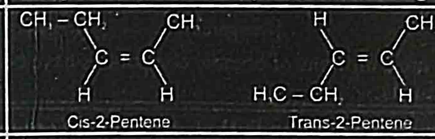
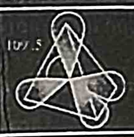
18.	(b) Saturated hydrocarbon	$C_8H_{18} \longrightarrow C_{14}H_{30}$ (Octane $\longrightarrow$ Buta decane)
19.	(c) iso-octane	It is 2, 2, 4 – Trimethyl pentane.
20.	(a) Cracking	Decomposition of higher boiling hydrocarbon into low boiling hydrocarbon
21.	(a) Catenation	Self linkage property of an element.
22.	(a) $C_5H_{18} - C_{14}H_{30}$	This shows kerosene oil is saturated hydrocarbon.
23.	(c) Anthracite	It has 92-94% of C
24.	(b) Thioalcohol	This is used for sulphur.
25.	(d) All of the above	Ketones, ethers and esters show metamerism.
26.	(d) Functional group isomerism	C_2H_5OH and CH_3-OCH_3 are isomers.
27.	(c) It is a renewable energy resource.	Since it cannot used again and again, so it is non – renewable resource of energy.
28.	(d) Butane and Pentane	Butane (C_4H_{10}) and Pentane (C_5H_{12})
29.	(d) all of above,	By aromatization, isomerization and by adding TEL, we can increase the octane number
30.	(b) alicyclic compounds	 Cyclopropane, Cyclobutane, Cyclohexene
31.	(c) 3-Methyl–1–pentene–4–yne	$CH_2=CH-\underset{\displaystyle CH_3}{\underset{\vert}{C}}-C\equiv CH$
32.	(c) 4	i) $CH_3-CH_2-CH_2-CH_2-Cl$ (1 - Chlorobutane) ii) $CH_3-CH_2-\underset{\displaystyle Cl}{\underset{\vert}{CH}}-CH_3$ (2 - Chlorobutane) ii) $CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{C}}-CH_3$ $\quad\quad$ (2 - Chloro, 2 - Methylpropane) iv) $CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_2-Cl$ $\quad\quad$ (1 - Chloro, 2 - Methylpropane)

Additional MCQ's

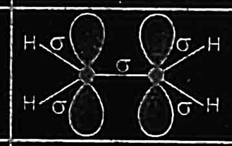
Q.No.	Answer	Reason
1.	(d) Fossil fuels	Coal, natural gas and petroleum are called fossil fuels.
2.	(a) NH_4CNO	$NH_4CNO \rightleftharpoons (NH_2)_2CO$
3.	(d) catenation	Self linking property of an element
4.	(c) $(C_6H_{10}O_5)_n$	Cellulose has also same molecular formula.
5.	(b) Non-polar solvent	(like dissolves in like, organic compounds and organic solvents both are non – polar in nature.)

Khatti Academy

6.	(a) Peat	Wood $\xrightarrow{\text{bacterial and Chemical reactions}}$ peat
7.	(b) Destructive distillation	Coal $\xrightarrow{\text{Carbonization or destructive distillation}}$ Coke / Coal tar / Coal gas; Coal tar $\xrightarrow{\text{Fractional distillation}}$ about 217 aromatic compounds
8.	(c) 20 – 60°C	It contains $C_1 - C_4$.
9.	(b) 175 – 325°C	Kerosene contains C_8H_{18} to $C_{14}H_{30}$.
10.	(c) 500°C, 2atm	Due to low temperature and pressure it is best method.
11.	(a) Knocking	It is due to low quality fuel
12.	(b) reduces	Low quality fuel reduces efficiency of engine.
13.	(d) both a & b	Both a & b are different names of same compound .
14.	(c) TEL	Tetrethyl lead $(C_2H_5)_4$ Pb
15.	(d) both a & c	Aliphatic & Acyclic are very close to each other.
16.	(b) Alicyclic	It resembles to aliphatic so it is called alicyclic compound.
17.	(b) Pyridine	 Pyridine contains N in its ring.
18.	(c) Alkanals	Alkanals is IUPAC name of aldehyde.
19.	(d) $-\overset{\overset{O}{\|\|}}{C}-NH_2$	Urea also contains this group, so it is acid amide.
20.	(a) Aldehydes	– CHO
21.	(c) Thiols	"Thiol" is used for sulphur.
22.	(b) 1:3	In sp^3, s – character is 25% and p – character is 75%. So in sp ratio is 1 : 3.
23.	(a) Over four billions	This shows that organic compounds are hundred billions in number.
24.	(c) Paraffins	"Paraffins" is used for alkane. Paraffins means little affinity. Alkanes are least reactive so they are called paraffins.
25.	(d) All of these	Asphalt is used for roofing, paving and fuel reducing agent.
26.	(a) 20%	This amount do not fulfill our requirements.
27.	(c) Composition	Conditions changes the composition.
28.	(c) steam cracking	(i) In Catalytic cracking gasoline is produced. (ii) In the thermal and steam cracking unsaturated hydrocarbons formed. But thermal cracking requires high temp. & pressure.
29.	(d) All of them	These products are obtained usually in steam cracking.
30.	(d) Both a & c	$(C_2H_5)_4$ Pb (Tetraethyl lead), $(CH_3)_4$ Pb (Tetramethyl lead)
31.	(a) 2,2-Dimethyl propane	$CH_3-\overset{\overset{CH_3}{\|}}{\underset{\underset{CH_3}{\|}}{C}}-CH_3$

32.	(a) Heterocyclic	Each contain element other than C in its ring.
33.	(d) All of them	(i) Cl atom (ii) OH group of atoms. (iii) =, ≡ are functional group
34.	(d) Both a & c	Alcohol = if H of water is replaced by –R Ethers = if both H of water replaced by – R
35.	(a) 14	
36.	(a) Hexagonal	
37.	(c) sp^3	In sp^3 state, no double or triple bond is formed.
38.	(d) both b & c	Alkene has sp^2 carbon and Alkyne has sp carbon hybradized
39.	(b) Alkene	 σ – bonds; π – bond
40.	(c) Two	$2p_y$ and $2p_z$ are unhybridized
41.	(b) Butane	It has minimum 2 isomers. Butane and 2-methylpropane.
42.	(d) None of these	Propane $(CH_3-CH_2-CH_3)$ has no isomer.
43.	(c) Different physical properties	Boiling points of branched chain isomers are less than isomeric normal chain isomers.
44.	(c) cis – trans isomerism	Compounds differ in the position of same groups in space.
45.	(d) Geometric isomerism	 Cis-2-Pentene; Trans-2-Pentene
46.	(b) Two	$CH_3-CH=CH-CH_3$ 2 – Butene; $CH_2=CH-CH_2-CH_3$ 1 – Butene
47.	(c) Ethyl formate	$HCOOC_2H_5$
48.	(b) sp	Carbon is attached with two further atoms.
49.	(d) All of the above	(a) all carbons are sp^3 hybradized (b) All carbons are sp^2 hybridized (c) all carbons are sp hybridized.
50.	(a) Open chain	CH_3CH_3 & $CH_3-CH_2-CH_3$ are aliphatic & they are open.
51.	(a) Wohler	He obtained urea from NH_4CNO.
52.	(c) Tetrahedral	

Bharti Academy

53.	(a) Alkanes	$C_5H_{14} - C_7H_{16}$
54.	(b) Octane number	Quality of gasoline ∝ Octane number.
55.	(c) R_2CO	R – R – Ketone, carbonyl group is attached with ??? alkyl group.
56.	(d) 6	
57.	CH ≡ CH	In alkyne Carbon is sp hybridized.
58.	(a) Alkane	Alkane does not show positional isomer because have no proper functional group.
59.	Highly branched chain paraffins	Branched chain hydrocarbons have high octane number and burn smoothly.
60.	(d) Vegetable oil	Vegetable oil contains oxygen so it is not a hydrocarbon.

Short Answers Questions

1. Discuss the importance of Wohler's work in the development of organic chemistry.
Q. How vital force theory was discarded by F. Wohler?
Q. Which organic compound was first of all prepared in the laboratory?

Ans. Wohler's Work in the Development of Chemistry

F. Wohler was a German chemist. He rejected vital force theory by preparing urea in the laboratory. He obtained urea $(NH_2)_2CO$, an organic compound in the urine of mammals, from ammonium cyanate, NH_4CNO, a substance of known mineral origin.

$$NH_4CNO \rightleftharpoons (NH_2)_2CO$$

Ammonium cyanate (Inorganic) — Urea (Organic)

Since the synthesis of urea, millions of organic compounds have been prepared. In this way, organic compounds make progress by leaps and bounds.

2. How vital force theory came to its end? How definition of organic compounds changed after the end of the theory?

Ans. Vital Force Theory

This theory was introduced by J-Berzillius in 1815.
According to this theory:

"Organic compounds can be prepared by and within the living things and cannot be synthesized from inorganic materials in laboratory because a vital force is involved in their preparation."

Rejection of Vital Force Theory:

The vital force theory was rejected by a German chemist Friedrich Wohler when he prepared urea in laboratory. He obtained urea $(NH_2)_2CO$, an organic compound in the urine of mammals, from ammonium cyanate, NH_4CNO, a substance of known mineral origin.

$$NH_4CNO \rightleftharpoons (NH_2)_2CO$$

Ammonium cyanate (Inorganic) — Urea (Organic)

Since the synthesis of urea, millions of organic compounds have been prepared and analyzed in the laboratory.

Modern definition of Organic Compounds:

"Hydrocarbons and their derivatives are called organic compounds."

3. Define catenation. OR
A large number of organic compounds is due to the catenation of carbon. Justify.

Ans. Catenation

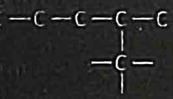
"The self-linking property of an element is called catenation."

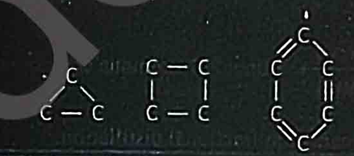
Carbon shows maximum catenation property due to high C – C bond energy. Carbon is a unique element and it is essential element of organic compounds. Its unique features are as follows:

(1) Carbon can form straight chain, branched chain and cyclic compounds.

Examples

(a) C – C – C – C – C – C
Straight chain

(b)

Branched chain

(c)

Cyclic chain

(d) C – C, C = C, C ≡ C

(e) Carbon also forms bonds with H, O, N, S, P, X.

Due to these reasons, a large number of organic compounds are due to catenation property of carbon.

4. What do you mean by homologous series?

Ans. Homologous Series

"A group of chemical compounds which are structurally alike and have same chemical properties belong to a homologous series."

∘ In a homologous series two successive members of group differ from each other by a $-CH_2-$ group or a mass of 14.

The members of a homologous series generally have same:

(i) General formula.
(ii) Methods of preparations.
(iii) Chemical properties
(iv) Functional group.
(v) A gradual change in physical properties.

Examples:

Alkenes, Alcohols, Ketones etc.

5. How coal is formed? Give its different forms.

Ans. Formation of Coal

It is believed that coal in nature was formed from the remains of trees buried inside the earth crust some 500 million years ago. Due to the bacterial and chemical reactions on wood it got converted into peat. Then, as a result of high temperature and high pressure inside the earth crust, peat got transformed into coal.

Wood (Dead plants and trees) —bacterial & chemical reactions→ **Peat** —high temperature, high pressure→ **Lignite** —pressure→ **Bituminous coal** —pressure→ **Anthracite**

bhattiAcademy

6. What is coal? Give its importance.

Ans. Coal

"Coal is a combustible black or brownish-black sedimentary rock usually occurring in rock-strata."

Importance of Coal:

(i) About 80% of coal (in Pakistan) is used to bake bricks in lime kilns.
(ii) Some quantity is used for domestic purposes.
(iii) It is used in power generating stations.
(iv) It is used to get useful organic compounds.

7. Define carbonization of coal.

Ans. Carbonization (Destructive Distillation) of Coal

"When coal is heated at high temperature (500 – 1000°C) and in the absence of air, it is converted into coke, coal gas and coal tar. This process is called carbonization of coal."

Coal —(Carbonization or destructive distillation)→ Coke, Coal tar, Coal gas
Coal tar —(Fractional distillation)→ about 217 aromatic compounds

Coal tar contains a large number of organic compounds, which separate on fractional distillation.

8. Define Natural gas. Write down it sues.

Ans. Natural Gas

"A gaseous mixture of low-boiling hydrocarbons which mainly composed of methane is called natural gas."

Composition:

Major portion of the natural gas is methane. Others are ethane, propane and butane. A small amount of CO_2, N_2, H_2S and He are also present in natural gas.

Uses:

It is used:

(i) for power generation .
(ii) as a fuel in general industries.
(iii) in cement and fertilizer industries.
(iv) for domestic purpose.
(v) as CNG and LNG for automobile fuel.

9. What is Petroleum? Give its origin.

Ans. Petroleum

"Mineral oil in its refined form is called petroleum."

Origin of Petroleum:

It is thought to have been formed by slow chemical and biochemical decomposition of the remains of organic matters found between the **sedimentary rocks.** When extracted from rocks, it appears like a liquid of blackish colour known as **crude oil.** It is refined to get different petroleum fractions.

10. Name the fractions which are obtained by Fractional Distillation of Petroleum.

Ans. Fractions of Petroleum

Fraction	Boiling Point Range (°C)	Composition	Uses
Natural gas	< 20	CH_4-C_4H_{10}	Fuel, petrochemicals
Petroleum ether	20-60	C_5H_{12}, C_6H_{14}	Solvent
Ligroin, or naphtha	60-100	C_6H_{14}, C_7H_{16}	Solvent, raw material
Gasoline	40-220	C_4H_{10}-$C_{13}H_{28}$ mostly C_6H_{14}-C_8H_{18}	Motor fuel
Kerosene	175-325	C_8H_{18} – $C_{14}H_{30}$	Heating fuel
Gas oil	> 275	$C_{12}H_{26}$ – $C_{18}H_{38}$	Diesel and heating fuel
Lubricating oils and greases	Viscous liquids	> $C_{18}H_{38}$	Lubrication
Paraffin	M.p. 50-60	$C_{23}H_{48}$-$C_{29}H_{60}$	Wax products
Asphalt, or petroleum coke	Solids	Residue	Roofing, paving, fuel reducing agent

11. Define cracking. Give its important.

Ans. Cracking or Pyrolysis

"Thermal decomposition of higher hydrocarbons having high boiling points into variety of lower hydrocarbons, which are more volatile (low boiling) in the absence of air is called cracking."

Example:

A higher hydrocarbon, $C_{16}H_{34}$ (hexadecane) cracks according to the following reaction.

$$C_{16}H_{34} \xrightarrow[700^\circ C]{\text{Heat}} C_7H_{16} + 3\,CH_2 = CH_2 + CH_3 - CH = CH_2$$

Alkane — Heptane — Ethene — Propene

Importance:

(i) The fractional distillation of petroleum yields only about 20% gasoline. Due to its high demand, this supply is augmented by converting surplus supplies of less desirable petroleum fractions such as kerosene oil and gas oil into gasoline by a process called cracking.
(ii) Besides increasing the yield of gasoline, cracking has also produced large amounts of useful by products, such as ethene, propene, butene and benzene. These are used for manufacturing drugs, plastics, detergents, synthetic fibres, weed killers, fertilizers and important chemicals like ethanol, phenol and acetone.

12. Explain thermal cracking. Write formulas of any two compounds obtained by this phenomenon.

Ans. Thermal Cracking

Breaking down of large molecules by heating at high temperature and pressure is called thermal cracking.

Nature of product:

It is particularly useful in the production of unsaturated **hydrocarbons** such as ethene and propene.

Formulas of two compounds obtained by this phenomenon:

$CH_2 = CH_2$, CH_3-CH=CH_2
ethene propene

13. What is catalytic cracking of petroleum?

Ans. Catalytic Cracking

Higher hydrocarbons can be cracked at lower temperature (500°C) and lower pressure (2atm), in the presence of a suitable catalyst. A typical catalyst used for this purpose is a mixture of silica (SiO_2) and alumina (Al_2O_3).

Nature of Product:

Catalytic cracking produces **gasoline** of higher octane number. This method is used for obtaining better quality gasoline.

14. How does cracking and reforming differ from each other?

Ans.

Cracking	Reforming
The thermal decomposition of higher hydrocarbons having high boiling points into variety of lower hydrocarbons, which are more volatile (low boiling) is	The thermal conversion of straight chain hydrocarbons into branched chain hydrocarbon in the absence of oxygen (air) and in the presence of a catalyst is called reforming.

Khattak Academy

called cracking.	
$C_7H_{16} \xrightarrow[700\,C]{Heat} C_5H_{12} + 3\,CH_2 = CH_2 - CH_3 - CH = CH_2$ Alkane Heptane Ethene Propene	$CH_3-(CH_2)_6-CH_3 \xrightarrow[Catalyst]{Heat} CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-\underset{\overset{|}{CH_3}}{CH}-CH_3$ n-octane 2,2,4 -Trimethylpentane (Iso -octane)
It is used to convert surplus supplies of less desirable petroleum fractions (gas oil) into gasoline.	It is used to improve the octane number of gasoline.

15. What is an octane number and how it is improved?

Ans. Octane Number

"The percentage of branched chain hydrocarbon (Iso-Octane) in gasoline fraction of petroleum is called Octane number."

- Iso-octane (2, 2, 4–Trimethyl pentane) has been arbitrarily given an octane number of 100 while n-heptane has given an octane number zero.

Improvement of Octane number:

Octane number of gasoline can be improved by various ways:

(i) Reforming
(ii) Aromatization
(iii) Blending with TEL
(iv) Addition of aromatic compounds (BTX)

16. What is meant by knocking of petroleum? Write two names and formulas of anti-knock agents used in gasoline.

Ans. Knocking

"The sharp metallic sound produced when low quality fuel burns in internal combustion engine is called knocking."

Knocking greatly reduces the efficiency of an engine.

Anti-Knock Agents:

The two anti-knock agents used in gasoline are:

(i) Tetramethyl lead $(CH_3)_4$ Pb
(ii) Tetraethyl lead $(C_2H_5)_4$ Pb

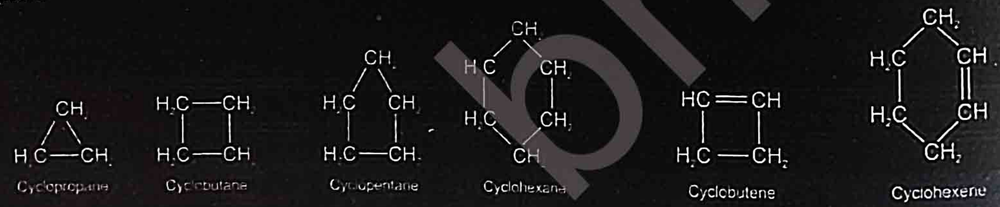
17. What are alicyclic compounds? Give two examples.

Ans. Alicyclic compounds

"The homocyclic compounds which contain a ring of three or more carbon atoms and resembling aliphatic compounds are called alicyclic compounds."

- The saturated alicyclic hydrocarbons (cycloalkanes) have the general formula C_nH_{2n} while unsaturated (cycloalkenes) have the general formula C_nH_{2n-2}.

Examples:



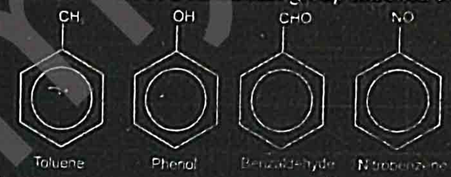
18. Define Aromatic compounds with three examples.

Ans. Aromatic Compounds

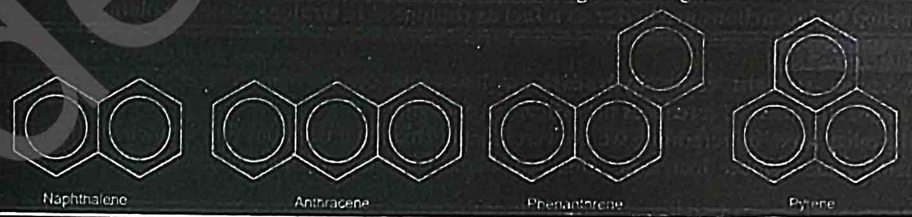
"These carbocyclic compounds which contain at least one benzene ring. (six carbon atoms with three alternate double and single bonds) is called aromatic compounds."

Examples:

(i) The aromatic compounds may have a side-chain or a functional group attached to the ring. For examples:

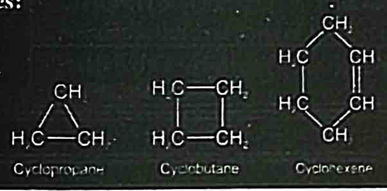
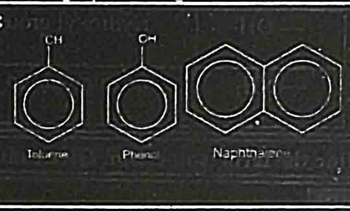


(ii) The aromatic compounds may also contain more than one benzene rings fused together.



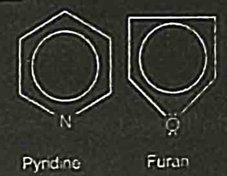
19. Differentiate between Alicyclic and Aromatic compounds.

Ans.

Alicyclic Compounds	Aromatic Compounds
∘ The homocyclic compounds which contain ring of three or more carbon atoms and resembling the aliphatic compounds are called alicyclic compounds.	∘ The homocyclic compounds which contain atleast one benzene ring are called aromatic compounds.
∘ They may be saturated or unsaturated.	∘ They may contain one or more benzene rings.
∘ They have low percentage of carbon.	∘ They have high percentage of carbon.
Examples: 	**Examples:** 

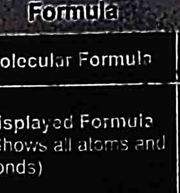
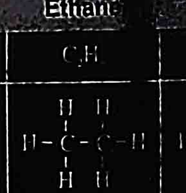
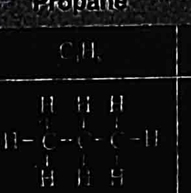
20. Give names and formulas of two heterocyclic aromatic compounds:

Ans. Heterocyclic Aromatic Compounds



According to **Huckle rule**, these are non–benzenoid **aromatic compounds.**

Bhatti Academy

Formula	Ethane	Propane	Butane
Molecular Formula	C_2H_6	C_3H_8	C_4H_{10}
Displayed Formula (Shows all atoms and bonds)			
Structural Formula	CH_3CH_3	$CH_3CH_2CH_3$	$CH_3CH_2CH_2CH_3$
Skeletal formula			

21. Branched hydrocarbons are better as a fuel as compared to straight chain. Explain.

Ans. Hydrocarbons as Fuel

Fuel having **straight chain hydrocarbons** have low octane number and produces knocking in internal combustion engine. In this way, it reduces the efficiency of engine.

On the other hand, by reforming we convert straight chain hydrocarbons into **branched chain hydrocarbons.** In this way, their octane number increases. This fuel burns smoothly in internal combustion engine and increases its efficiency.

22. What do you mean by functional group?

Ans. Functional Group

"An atom or a group of atoms or a double bond or a triple bond whose presence imparts specific properties to organic compounds is called a functional group."

- They are the chemically functional parts of molecules.
- Each functional group defines an organic family.

Examples:

Functional group		Class of compounds	Example
— OH	Hydroxyl group	Alcohol or alkanol	CH_3-CH_2-OH Ethanol
— NH_2	Amino group	Amine	$CH_3-CH_2-NH_2$ Ethyl amine

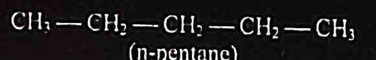
23. Define the term isomerism. Give examples.

Ans. Isomerism

"Two or more compounds having the same molecular formula but different structural formulas and properties are said to be isomers and the phenomenon is called isomerism."

Examples:

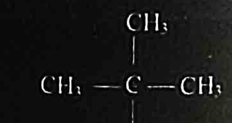
C_5H_{12}:



(n-pentane)



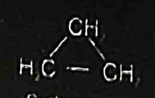
2-Methylbutane (Iso-pentane)



2, 2-Dimethylpropane (Neo-pentane)

C_3H_6: $H_3C - CH = CH_2$

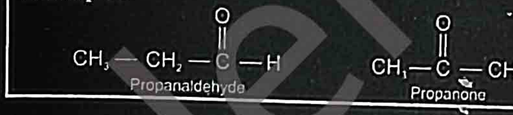
propene



Cyclopropane

24. How functional group isomerism differs from metamerism? Give examples.

Ans.

Functional Group Isomerism	Metamerism
∘ The compounds having the same molecular formula but different functional groups are said to exhibit functional group isomerism.	∘ This type of isomerism arises due to the unequal distribution of carbon atoms on either side of the functional group.
∘ Such compounds belong to different homologous series.	∘ Such compounds belong to the same homologous series.
Example:  Propanaldehyde Propanone	**Example:** $CH_3 - CH_2 - O - CH_2 - CH_3$ Diethyl ether $CH_3 - O - CH_2 - CH_2 - CH_3$ Methyl–n–propyl ether

25. Define position isomerism with one example.

Ans. Position Isomerism

This type of isomerism arises due to the difference in the position of the same functional group on the carbon chain. The arrangement of carbon atoms remains the same.

Examples:

C_3H_7Cl: $CH_3 - CH_2 - CH_2 - Cl$ 1 – Chloropropane; $CH_3 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH_3$ 2 – Chloropropane

C_4H_8: $CH_3 - CH_2 - CH = CH_2$ 1 – Butene; $CH_3 - CH = CH - CH_3$ 2 – Butene

26. What is meant by functional group and functional group isomerism?

Ans. Functional Group

"An atom or a group of atoms or a double bond or a triple bond whose presence imparts specific properties to organic compounds is called a functional group."

- They are the chemically functional parts of the molecules.
- Each functional group defines an organic family. e.g. –O–, – SH, – NH_2, – X etc.

Functional Group Isomerism

"The compounds having the same molecular formula but different functional groups are said to exhibit functional group isomerism."

Example:

C_2H_6O:

$CH_3 - O - CH_3$ (Dimethyl ether); $CH_3 - CH_2 - OH$ (Ethyl alcohol)

27. What type of structural isomerism is shown by ethers? Give on example.

Ans. Structural isomerism shown by ethers

Ethers show **metamerism** which arises due to the unequal distribution of the carbon atoms on the either side of the same functional group.

Example:

$C_4H_{10}O$:

$CH_3 - O - CH_2 - CH_2 - CH_3$ Methyl – n – propylether; $CH_3 - CH_2 - O - CH_2 - CH_3$ Diethyl ether.

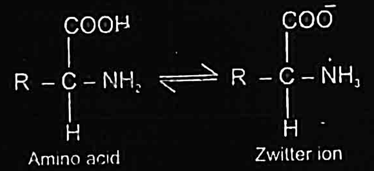
bhattiAcademy

28. Define Tautomerism with example.

Ans. Tautomerism

This type of isomerism arises due to shifting of proton (H^+) from one atom to other in the same molecule.

Examples:





29. From where does the energy come to excite the carbon atom in the hybridization?

Ans. Before excitation the carbon atom should make two covalent bonds releasing an adequate amount of energy. After excitation, however, it will form four covalent bonds releasing almost double the amount of energy. This excess energy is more than that needed to excite the carbon atom. So a tetravalent carbon atom is expected to be more stable than a divalent carbon atom.

30. Explain the type of bonds and shapes of the following molecules using hybridization approach.

CH_3-CH_3, $CH_2 = CH_2$, $CH \equiv CH$, HCHO, CH_3Cl

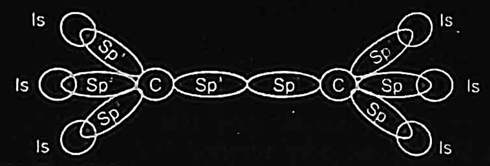
Ans. (i) Ethane ($H_3C - CH_3$)

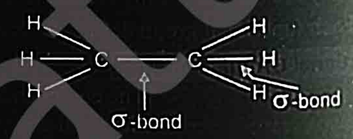
$_6C = 1s^2. 2s^2. 2p^1_x. 2p_y{}^1. 2p^0_z$ (Ground state)

Hybridization: sp^3

$_6C = 1s^2. 2s^1. 2p_x{}^1. 2p^1_y. 2p_z{}^1$ (Excited state) $_6C = 1s^2. \overset{1}{sp^3}.\overset{1}{sp^3}.\overset{1}{sp^3}.\overset{1}{sp^3}.$ (Hybridized state)

Bonding:





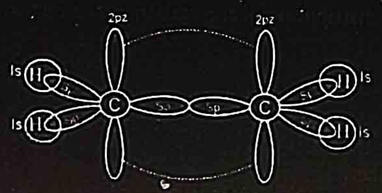
(ii) Ethene ($H_2C = CH_2$):

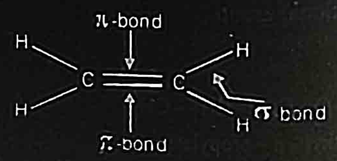
Central atom = C

$_6C = 1s^2. 2s^2. 2p^1_x. 2p_y{}^1. 2p^0_z$

$_6C = 1s^2. 2s^1. 2p_x{}^1. 2p^1_y. 2p^1_z$ Hybridization: sp^2 $_6C = \overset{1}{sp^2}.\overset{1}{sp^2}.\overset{1}{sp^2}.\overset{1}{2p_z}$

Bonding:



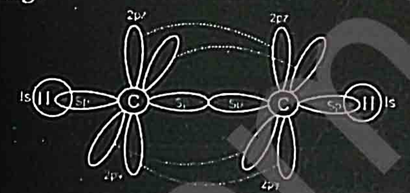


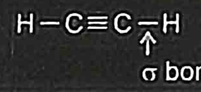
(iii) Ethyne ($HC \equiv CH$)

$_6C = 1s^2. 2s^2. 2p^1_x. 2p^1_y. 2p^0_z$

$_6C = 1s^2. 2s^1. 2p_x{}^1. 2p^1_y. 2p^1_z$ **sp Hybridization:** $_6C = \overset{1}{sp}.\overset{1}{sp}.2py.2pz.$

Bonding:





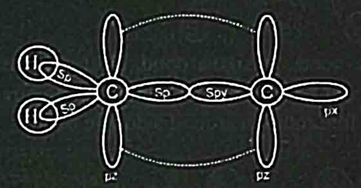
(iv) Formaldehyde: $H - \overset{O}{\overset{\|}{C}} - H$

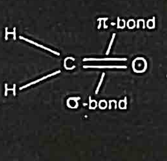
Central atom = C

$_6C = 1s^2. 2s^2. 2p^1_x. 2p^1_y. 2p^0_z$

$_6C = 1s^2. 2s^1. 2p_x{}^1. 2p^1_y. 2p^1_z$ **Hybridization: sp^2** $_6C = \overset{1}{sp^2}.\overset{1}{sp^2}.\overset{1}{sp^2}.\overset{1}{2p_z}.$

Bonding:





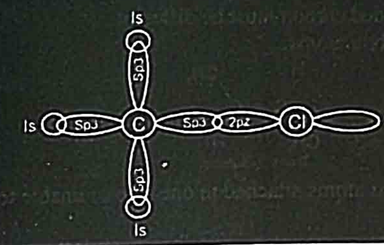
(v) Methyl chloride: CH_3Cl

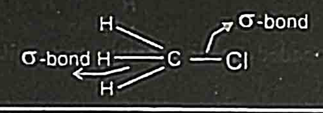
Central atom = C

$_6C = 1s^2. 2s^2. 2p^1_x. 2p^1_y. 2p^0_z$

$_6C = 1s^2. 2s^1. 2p_x{}^1. 2p^1_y. 2p^1_z$ **Hybridization: Sp^3 –** $_6C = 1s^2. \overset{1}{sp^3}.\overset{1}{sp^3}.\overset{1}{sp^3}.\overset{1}{sp^3}.$

Bonding:





31. What is cis-trans isomerism? Give example.

Ans. Cis-trans Isomerism (Geometric Isomerism)

"Those compounds which possess the same structural formula, but differ with respect to the positions of the identical groups in space are called cis-trans isomers and the phenomenon is known as cis-trans or geometric isomerism."

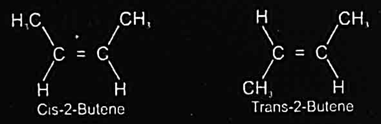
bhattiAcademy

Necessary Conditions:

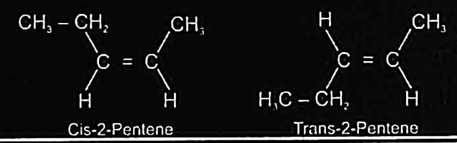
The necessary and sufficient condition for a compound to exhibit geometric isomerism is that the two groups attached to the each double bonded carbon must be different.

Examples:

C_4H_8:



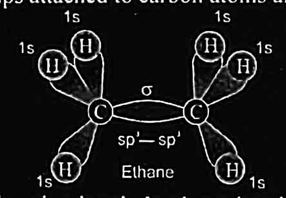
C_5H_{10}:



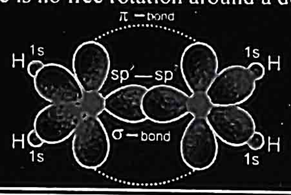
32. Why is there no free rotation around a double bond and free rotation around a single bond?

Ans. Rotation around a double and single bond

A single bond is formed by the linear overlapping of sp^3 orbitals of two carbon atoms. Due to which a sigma bond is formed between the two nuclei and the groups attached to carbon atoms are capable of free rotation.



A double bond contains a sigma σ and a pi π-bond. In sigma bond, electron density lies between the two nuclei while in π-bond, electron density is formed above and below the line joining the two nuclei. It causes hindrance in the movement of attached groups. Therefore, there is no free rotation around a double bond.

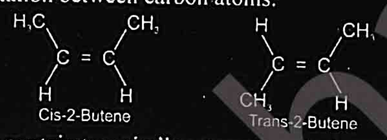


33. 1-butene does not show geometrical isomerism but 2-butene exhibit geometrical isomerism. Why?

Ans. The necessary and sufficient conditions for a compound to exhibit geometric isomerism are that:

(i) The two groups attached to the each double bonded carbon must be different.

(ii) There should be restricted rotation between carbon atoms.



- In **1-Butene,** double bonded carbons contain two similar atoms attached to one side so unable to show geometric isomerism.
- 2-Butene does show cis-trans isomerism because double bonded carbons contain two different groups.

Why is restricted rotation necessary to show the geometrical isomerism?

Or

Geometric isomerism is originated due to restricted rotation around a double bond. Comment.

Ans. Restricted rotation around double bond

Two carbon atoms joined by a single bond are capable of free rotation. However, when two carbon atoms are joined by a double bond. they cannot rotate freely. As a result, the relative positions of the various groups attached to carbon atoms get fixed and gives rise to cis-trans isomers.

The rotation of two carbon atoms joined by a double bond could happen only if the π-bond breaks. This ordinarily costs too much energy, making geometric isomers possible.

35. Write structural formulas of the two possible isomers of C_4H_{10}. Also write their IUPAC names.

Ans. Structural formulas & IUPAC names of isomers of butane

The two possible structures of butane are:

(i) $CH_3-CH_2-CH_2-CH_3$

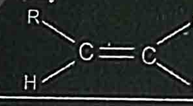
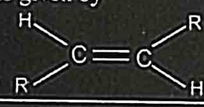
n – Butane

(ii) $CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

2 – Methyl propane

36. Differentiate between cis and trans isomers.

Ans.

Cis - isomer	Trans - isomer
1. The geometric isomer in which the two bulky group are present on the same side of the double bond is called cis isomer.	1. The geometric isomer in which the two bulky groups are present on the opposite side of the double bond is called trans isomer.
2. Cis isomer is given by 	2 Trans isomer is given by 
3. Generally cis form of a compound is unstable due to stearic hindrance of bulky groups.	3. The trans form of a compound is stable due to opposite presence of bulky groups.

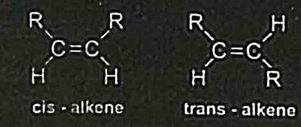
37. Trans-isomer is more stable than cis-isomers. Justify.

Ans. **Stability of cis – trans isomers:**

Cis-form of a compound is generally unstable because two bulky groups are on the same side of double bond. These groups cause stearic hindrance making cis-isomer unstable.

In trans-form bulky groups are on the opposite side of the double bond. Due to absence of stearic hindrance trans-isomer is more stable.

Example:



****

PhatiAcademy

CHAPTER 8

ALIPHATIC HYDROCARBONS

Solved Objective Exercise

Q1. Fill in the blanks.

(i) Ozone reacts with ethene to form _____.
(ii) Lindlar's catalyst is used for _____ of alkynes.
(iii) Divinyl acetylene is a _____ acetylene.
(iv) Vicinal dihalides have two halogens on _____ carbon atoms.
(v) Ethyne is acidic in character because of _____ hybridization.
(vi) Halohydrins are formed due to addition of _____ in ethene.
(vii) Ethylene glycol is produced when _____ reacts with cold alkaline $KMnO_4$ solution.
(viii) Mustard gas is a high boiling _____.
(ix) Ethyne has _____ like odour.
(x) Ethyne is obtained by the reaction of _____ with calcium carbide.

Answer Key.

(i)	Ozonide	(ii)	Partial hydrogenation
(iii)	Polymer of	(iv)	Adjacent
(v)	sp.	(vi)	Hypohalous acid
(vii)	Ethene	(viii)	Liquid
(ix)	Garlic	(x)	Water

Q2. Indicate True or false.

(i) Addition of HX to unsymmetrical alkanes takes place according to Markownikov's rule.
(ii) Methane reacts with bromine water and its colour is discharged.
(iii) Mustard gas is a blistering agent.
(iv) Methane is also called marsh gas.
(v) Ethyne is a saturated compound.
(vi) Baeyer's reagent is used to locate a double bond in an alkene.
(vii) Alkanes usually undergo substitution reactions.
(viii) Benzene is a polymer of ethene.
(ix) Acrylonitrile can be obtained from ethyne.
(x) Ethyne is more reactive towards electrophilic reagents than ethene.

Answer Key.

(i)	False	(ii)	False	(iii)	True	(iv)	True	(v)	False
(vi)	True	(vii)	True	(viii)	False	(ix)	True	(x)	False

bhattiAcademy

Q3. Multiple Choice Questions. Encircle the correct answer.

(i) **Preparation of vegetable ghee involves** **(Fsd 2010)**
(a) Halogenation (b) Hydrogenation (c) Hydroxylation (d) Dehydrogenation

(ii) **Formula of chloroform is:**
(a) CH_3Cl (b) CCl_4 (c) CH_2Cl_2 (d) $CHCl_3$

(iii) **The presence of a double bond in a compound is the sign of:**
(a) Saturation (b) Unsaturation (c) Substitution (d) None

(iv) **Vinyl acetylene combines with HCl to form:** **(Lhr 2008)**
(a) Polyacetylene (b) Benzene (c) Chloroprene (d) Divinyl acetylene

(v) **The addition of unsymmetrical reagent to an unsymmetrical alkene is in accordance with the rule**
(a) Hund's rule (b) Markownikov's rule
(c) Pauli's Exclusion principle (d) Auf bau principle

(vi) **Synthetic rubber is made by polymerization of:** **(Fsd, Lhr 2009)**
(a) Chloroform (b) Acetylene (c) Divinylacetylene (d) Chloroprene

(vii) **β,β′ – dichloroethyl sulphide is commonly known as:** **(Lhr 2012)**
(a) Mustard gas (b) Laughing gas (c) Phosgene gas (d) Bio-gas

(viii) **When methane reacts with Cl_2 in the presence of diffused light, the products obtained are:**
(a) Chloroform only (b) Carbon tetrachloride only
(c) Chloromethane and dichloromethane (d) Mixture of a, b, c

(ix) **Which one of the following gases is used for artificial ripening of fruits:** **(Grw 2008)**
(a) Ethene (b) Ethyne (c) Methane (d) Propane

Solved Exercise MCQ's

Q.No.	Answer	Reason
(i).	(b) Hydrogenation	Vegetable Oil+$H_2 \xrightarrow[200^\circ C]{Ni}$ Vegetable ghee
(ii).	(d) $CHCl_3$	Trichloromethane ($CHCl_3$) is also called chloroform.
(iii).	(b) Unsaturation	It means any molecule can add into it. $CH_2 = CH_2$ is unsaturated compound.
(iv).	(c) Chloroprene	$CH_2 = CH - C \equiv CH + HCl \rightarrow CH_2 = CH - \underset{\underset{Cl}{\vert}}{C} = CH_2$
(v).	(b) Markownikov's rule	Negative part of attacking reagent goes to that carbon containing double bond and has least number of hydrogen atoms.
(vi).	(d) Chloroprene	Chloroprene $\xrightarrow{\text{Polymerization}}$ Neoprene (Synthetic rubber).
(vii).	(a) Mustard gas	It is not a gas but a high boiling liquid.
(viii).	(d) Mixture of a, b, c	First form CH_3Cl then CH_2Cl, $CHCl_3$ and CCl_4 respectively.
(ix).	(a) Ethene	Ethyne is used for ripening of fruits.

Previous Boards MCQ's

1. **Which type of reactions are given by alkanes** **(D.G Khan 08)**
(a) Addition (b) substitution (c) Elimination (d) Polymerization

2. **Alkanes are non-polar, they are soluble in** **(D.G Khan 09)**
(a) Diethylether (b) Benzene (c) Toluene (d) All of these

3. **Acetylene polymerises to make** **(D.G Khan 09)**
(a) 1,3,5 – Cyclohexatriene (b) Benzene (c) Butane (d) Hexane

4. **Wolf - Kishner's reduction reduces aldehyde into** **(D.G Khan 10)**
(a) Alkyne (b) Alkene (c) Alkane (d) Alcohol

5. **Baeyer's reagent is** **(Rwp 08)**
(a) Dilute alkaline $KMnO_4$ sol (b) $HCl + ZnCl_2$ (c) Br_2 in CCl_4 (d) All of these

6. **Addition of hydrogen accompanied by a bond cleavage is called** **(Rwp 09)**
(a) Hydrogenation (b) Hydrolysis (c) Hydrogenolysis (d) Hydroxylation

7. **In Ethene, each carbon atom is** **(Rwp 10)**
(a) sp^3 hybridized (b) sp^2-hybridized (c) sp – hybridized (d) Unhybridized

8. **Marsh gas is** **(Fsd 08)**
(a) CH_4 (b) C_2H_4 (c) C_3H_8 (d) C_4H_{10}

9. **The formula of dichloromethane is**
(a) Cl_2CH_2 (b) $CHCl_3$ (c) CH_3Cl (d) CCl_4

10. **The presence of double or triple bond in a compound is the sign of** **(Sgr 10)**
(a) Unsaturation (b) Saturation (c) Addition (d) Substitution

11. **β - β′ dichloroethyl sulphide prepared by treating sulphur monochloride with** **(Grw 10)**
(a) Ethane (b) Ethene (c) Ethyne (d) Methane

12. **Lindlar's catalyst is** **(Grw 11)**
(a) $Ba(PbSO_4)$ Quinoline (b) $Pd(PbSO_4)$ Quinone
(c) $Pd(BaSO_4)$ Quinoline (d) $Ba(PbSO_4)$ Quinoline

13. **Sabatier-Sendern's reaction can be used to prepare** **(Lhr 10)**
(a) Alkynes (b) Alkenes (c) Alkanes (d) All of these

14. **The isomerism shown by alkanes is** **(Lhr 11)**
(a) Skeletal (b) Position (c) Geometric (d) Metamerism

15. **Chloroprene is used for making:** **(Grw 12)**
(a) Rubber (b) Petrol (c) Propane (d) Liquid fuel

Entry Test MCQ's

1. **The alkane which has only primary hydrogen atoms is**
(a) Pentane (b) Neopentane (c) Isopentane (d) 2,2-dimethylbutane

2. **Dehydration of alcohol involves**
(a) Free radical (b) Carbanion (c) Carbocation (d) Carbene

3. **The addition of HBr to propylene takes place opposite to Markownikoff's rule in presence of:**
(a) Sunlight (b) Platinum catalyst (c) Hydrogen peroxide (d) Asbestos

4. **Halogenation of alkanes is an example of**
(a) Electrophilic substitution (b) Free radical substitution
(c) Nucleophilic substitution (d) Reduction

5. **Alkenes readily undergo**
(a) Substitution reactions (b) Elimination reactions

bnottmc

(c) Addition reactions (d) Rearrangement reactions

6. **Which of the following has the highest nucleophilicity**
(a) F^- (b) CH_3^- (c) OH^- (d) NH_2^-

7. **Which of the following is the most stable carbonium ion among the following**
(a) $C_6H_5C^+H_2$ (b) $C_6H_5CH_2C^+H_2$ (c) $CH_3C^+H_2$ (d) $C_6H_5C^+HC_6H_5$

8. **Which of the following is most reactive towards nucleophilic substitution reaction**
(a) $H_2C = CH - Cl$ (b) $CH_3CH = CHCl$ (c) CH_3COO^- (d) $NCCH_2^-$

9. **Baeyer's reagent in used in the laboratory for**
(a) Detection of unsaturation (b) Reduction
(c) Detection of glucose (d) Oxidation

10. **Carbon black, which is used in making printer's ink is obtained by decomposition of**
(a) Acetylene (b) Carbontetrachloride (c) Carbonmonoxide (d) Methane

11. **Formation of alkanes by action of Zn on alkylhalides is called**
(a) Frankland reaction (b) Wurtz reaction (c) Cannizzaro reaction (d) Kolbe's reaction

12. **1-Chlorobutane on reaction with alcoholic potash (KOH) gives**
(a) 1-butene (b) 2-butene (c) 1-butanol (d) 2-butanol

13. **Tetrabromoethane on heating with Zn gives**
(a) Ethyl bromide (b) ethane (c) Ethene (d) Ethyne

14. **When 2-Butyne is treated with dil. $H_2SO_4/HgSO_4$, the product formed is**
(a) 1-butanol (b) 2-butanol (c) Butanone (d) Butanoic acid

15. **Position of double bond in alkenes can be identified by**
(a) Bromine water (b) Ozonolysis
(c) Ammoniacal silver nitrate solution (d) Baeyer's reagent

16. **Ethane can be prepared by**
(a) Heating sodalime with sodium acetate (b) Electrolysis of sodium acetate
(c) Electrolysis of sodium succinate (d) Reduction of acetone

17. **Catalytic reduction of water gas gives**
(a) Acetylene (b) Ethane (c) Ethylene (d) Methane

18. **Ethylene is produced by**
(a) Dehydration of acetic acid (b) Mixing acetic acid and calcium formate
(c) Electrolysis of methyl alcohol (d) Passing C_2H_5OH vapours over hot Al_2O_3

19. **Which of the following reagents distinguish ethylene from acetylene?**
(a) Ammoniacal cuprous chloride (b) Alkaline $KMnO_4$ solution
(c) Br_2 water (d) Chlorine dissolved in CCl_4

20. **The gas, which is used for welding purposes is**
(a) CH_4 (b) C_2H_6 (c) C_2H_4 (d) None of these

21. **Conjugated double bond is present in**
(a) Propylene (b) Butylene (c) Isobutylene (d) Butadiene

22. **The only alcohol that can be prepared by the indirect hydration of alkene is**
(a) Ethyl alcohol (b) Isobutyl alcohol (c) Propyl alcohol (d) Methyl alcohol

23. $HC \equiv CH \xrightarrow[H_2SO_4]{HgSO_4} (A) \xrightarrow[HOH]{CH_3MgBr} (B) \xrightarrow{P\,Br_3} (C)$ **in this reaction, the final product (C) is**
(a) $CH_3CH(Br)CH_3$ (b) $CH_2 = CHBr$ (c) $CH_3CH_2CH_2Br$ (d) $BrHC = CH - CH_3$

Additional MCQ's

1. **Alkanes have general formula of:**
(a) C_nH_{2n+2} (b) C_nH_{2n} (c) C_nH_{2n-2} (d) C_nH_{2n-1}

2. **Kolbe's electrolytic process is suitable for the preparation of:**

(a) Unsymmetrical alkanes (b) Both a & c (c) Symmetrical alkanes (d) None

3. **Which of the following cannot be prepared from electrolytic process:**
(a) CH_4 (b) Ethane (c) Butane (d) a & c

4. **In Wolf-Kishner's reaction:**
(a) Aldehyde is reduced to alkane (b) Ketone is reduced to alkane
(c) Both reductions occur (d) None

5. **In Clemmensen reduction, carbonyl group:**
(a) Is reduced to methyl group (b) Is reduced to methylene group
(c) Is oxidized to methylene group (d) Is oxidized to methyl group

6. **The Wolf-Kishner reduction takes place in presence of:**
(a) N_2H_4/HCl (b) Zn-Hg/KOH (c) N_2H_4/KOH (d) Zn-Hg/HCl

7. **Which of the alkanes are colourless, odourless gases:**
(a) C_1-C_5 (b) C_1-C_3 (c) C_1-C_6 (d) C_1-C_4

8. **Which one of the following hydrocarbon is a wax solid:**
(a) $C_{16}H_{34}$ (b) $C_{18}H_{38}$ (c) $C_{17}H_{36}$ (d) None

9. **Alkanes are insoluble in:**
(a) Benzene (b) Ether (c) H_2O (d) None

10. **With increase in number of C atoms of alkanes:**
(a) Physical constants decrease and solubility decreases
(b) Physical constants increase and solubility decreases
(c) Both a & c (d) None

11. **Boiling points of alkanes increases by _____ for addition of each CH_2 group:**
(a) 30-50°C (b) 20-30°C (c) 60-90°C (d) None

12. **The unreactivity of alkanes is due to:**
(a) Inertness of sigma bond (b) Non polarity of C-C and C-H bond
(c) Both a & b (d) None

13. **What happens when alkanes react with HCl at ordinary temperature:**
(a) Chloro alkanes (b) Chloro alkenes (c) Both a & c (d) No reaction

14. **Complete combustion of an alkane yields:**
(a) CO_2, H_2O (b) CO_2, H_2O, CO (c) CO_2, H_2O+ Heat (d) None

15. **_____is the major reaction in engines of automobiles:**
(a) Hydrogenation (b) Combustion (c) Nitration (d) None

16. **The catalytic oxidation of alkane is used:**
(a) As fuel (b) To prepare higher fatty acids
(c) In organic synthesis (d) All

17. **Nitroalkanes are used:**
(a) As solvents (b) To prepare higher fatty acids
(c) As fuel (d) Both a and c

18. **The extent of halogenation of alkanes depends upon:**
(a) Pressure (b) Amount of halogen used
(c) Amount of hydrogen (d) None

19. **Order of reactivity of halogens is:**
(a) $Cl_2 > I_2 > F_2 > Br_2$ (b) $F_2 > Cl_2 > Br_2 > I_2$
(c) $Cl_2 > Br_2 > I_2 > F_2$ (d) $F_2 > Br_2 > I_2 > Cl_2$

20. **Amount of heat evolved when one mole of alkene is hydrogenated:**
(a) 220 $kJmol^{-1}$ (b) 200 $kJmol^{-1}$ (c) 210 $kJmol^{-1}$ (d) 120 $kJmol^{-1}$

Khattak Academy

21. Olefins is the second name of :
(a) Alkanes (b) Alkenes (c) Alkynes (d) Both b and c

22. Which one of the following hydrocarbons is a liquid:
(a) C_2H_4 (b) C_4H_8 (c) C_9H_{18} (d) C_3H_6

23. The dehydration of tertiary alcohols in presence of H_2SO_4 is carried at:
(a) 20% H_2SO_4 (b) 35% H_2SO_4 (c) 30% H_2SO_4 (d) 25% H_2SO_4

24. Which one of the following halogen does not react with alkene:
(a) F_2 (b) Cl_2 (c) Br_2 (d) I_2

25. In the addition of ____, molecules of the solvent become reactants too:
(a) Halous acid (b) Hypohalous acid (c) Halogen (d) Sulphuric acid

26. Baeyer's test is used for the detection of :
(a) Double bond (b) Saturation (c) Unsaturation (d) Both a and c

27. Ethene is polymerized in the presence of traces of:
(a) H_2O (b) O_2 (c) Cl_2 (d) N_2

28. Ethene is polymerized in the presence of :
(a) Aluminium triethyl (b) Aluminium tetraethyl (c) Titanium tetrachloride (d) Both a and c

29. IUPAC name of mustard gas is:
(a) β, β - dichloroethyl sulphide (b) β, β - dichloromethyl sulphide
(c) β, β - dichloroethyl sulphate (d) β, β - dichloro ethyl sulphite

30. Ethyne has _____ hydrogen atoms less than that of ethane
(a) One (b) Two (c) Five (d) Four

31. Tetrahaloalkanes form alkynes when they react with:
(a) Non-metals (b) Metal carbonates (c) Active metals (d) Strong base

32. On industrial scale, ethyne is formed by the reaction of :
(a) BrHC = CHBr (b) BrHC = CHBr + Zn (c) CaC_2+H_2O (d) All of these

33. Acetylene has_____ odour
(a) Onion like (b) Garlic like (c) No odour (d) Ginger like

34. Alkynes are less reactive because of:
(a) High electron density (b) Triple bond
(c) Less exposure toward electrophiles (d) All of these

35. Addition of halogens to alkynes take place in the presence of:
(a) CCl_4 (b) Zn, Pt, Pd (c) Al_2O_3 (d) Cu

36. The reaction of hydrogen bromide with ethyne is in accordance with:
(a) Charles law (b) Bohr's law (c) Hund's rule (d) Markownikov's Rule

37. Vinyl alcohol isomerises to:
(a) Acetaldehyde (b) Formaldehyde (c) Acetone (d) Vinyl halide

38. $CH \equiv CH + HCN \xrightarrow{Cu_2Cl_2,\ NH_4Cl}$:
(a) Acetaldelyde (b) Methyl nitrile (c) Acrylonitrile (d) Methyl cyanide

39. The formula of Glyoxal is:
(a) $CH_2 = CH - O - H$ (b) $C_2H_2O_4$ (c) $CH_3 - C \equiv N$ (d) $C_2H_2O_2$

40. _____ is used for welding and cutting of metals:
(a) Oxyacetylene flame (b) Oxidizing flame (c) Reducing Flame (d) All of them

41. Which of the following order is correct:
(a) Chloroprene → Neoprene → Vinyl acetylene (b) Neoprene → Vinylacetylene → Chloroprene
(c) Vinylacetylene → Neoprene → Chloroprene (d) Vinyl acetylene → Chloroprene → Neoprene

42. When acetylene passes through Cu-tube at 300°C it forms_____:
(a) Ethane (b) Benzene (c) None of these (d) Acetic Acid

43. CuC ≡ CCu (Dicopperacetylide) has ____ colour of ppt:
(a) Reddish Brown (b) White (c) Yellow (d) Red

44. A secondary carbon atom is one that is joined directly to :
(a) Methyl group (b) Three Alkyl groups (c) Two Alkyl groups (d) One Alkyl group

45. The type of hybridization on each carbon atom in the molecule $HC \equiv C - C \equiv CH$ is:
(a) Two sp, two sp^2 (b) sp^2 (c) sp (d) sp^3

46. In the process of Hydrogenolysis, Alkyl Halides React with Hydrogen in the presence of catalyst:
(a) Pb/C (b) Pd/C (c) CaO (d) Zn-Hg/HCl

47. Kolbe's Electrolytic Method has limited synthetic applications because of:
(a) Number of side products (b) Reaction occurs vigorously
(c) Reaction is reversible (d) Reaction is not feasible

48. The heat of combustion of an alkane in the presence of oxygen is:
(a) –782 $kjmol^{-1}$ (b) –891 $kjmol^{-1}$ (c) – 650 $kjmol^{-1}$ (d) –580 $kjmol^{-1}$

49. At high temperature and pressure lower alkanes are burnt in the presence of catalyst
(a) Ni (b) Pt, Pd (c) Pd/C (d) Cu

50. Nitromethane is prepared in drastic conditions at temp:
(a) 200-300°C (b) 300-400°C (c) 400-500°C (d) 500-600°C

51. In paints, printing inks and automobile tires, methane is used for the preparation of:
(a) Lead (b) Copper (c) Carbon Black (d) Alcohols

52. For the industrial preparation of Methyl alcohol, formaldelyde and Hydrogen Cyanide_____ is used:
(a) Ethane (b) Propane (c) Ethene (d) Methane

53. Alkanes react with halogens by a free radical mechanism to give:
(a) Halohydrin (b) Haloalkanes (c) Ninhydrin (d) Haloalkene

54. Methane is used to prepare fertilizers:
(a) Nitrogenous fertilizers (b) Urea fertilizers (c) Ammonia fertilizer (d) Phosphate fertilizers

55. Halogenation is believed to proceed through mechanism of:
(a) Substitution (b) Reduction (c) Free Radical (d) Oxidation

ANSWERS TO MCQ'S

Previous Board MCQ's

Q.No.	Answer	Reason
1.	(b) Substituion	Alkane has strong σ – bond and cannot break but at drastic condition, it gives substitution reaction.
2.	(d) All	Alkane are non-polar and dissolved in non-polar solvent (Benzene, Diethylether, Toluene) etc.
3.	(b) Benzene	$3C_2H_2 \xrightarrow[\text{Cu Tube}]{\text{300°C}} C_6H_6$
4.	(c) Alkane	$H_3C-\overset{O}{\overset{\|}{C}}-H + 4[H] \xrightarrow{Ni/Pt/Pd} H_3C-CH_3 + H_2O$
5.	(a) dilute alkaline $KMnO_4$ solution	(i) It is mild oxidizing agent. (ii) Pink in colour.

bhattiAcademy

		(iii) 1% $KMnO_4$ solution.
6.	(c) Hydrogenolysis	$CH_3-Cl+H-H \xrightarrow[\Delta]{Pd/C} CH_4+HCl$
7.	(b) sp^2-hybridized	$H_2C=CH_2$
8.	(a) CH_4	CH_4 (Methane) was found from Marshy places.
9.	(a) Cl_2CH_2	Dichloromethane
10.	(A) Unsaturation	$CH_2=CH_2$, $CH\equiv CH$ are unsaturated compounds and give addition reactions.
11.	(b) Ethene	$2CH_2=CH_2+S_2Cl_2 \longrightarrow S(CH_2-CH_2-Cl)_2 + S$
12.	(c) Pd $(BaSO_4)$/Quinoline	Finally divided palladium supported on $BaSO_4$ and poisoned by treatment with Quinoline (Lindlar's catalyst).
13.	(c) Alkane	$CH_2=CH_2+H_2 \xrightarrow[300°C]{Ni} CH_3-CH_3$ (Sabatier – Sendern's reaction)
14.	(a) Skeletal	Alkanes show any structural isomerism. $CH_3-CH_2-CH_2-CH_3$ (n – Butane) $CH-CH(CH_3)-CH_3$ (Iso - Butane)
15.	(a) Rubber	Chloroprene $\xrightarrow{Polymerization}$ Neoprene (rubber)

Entry Test MCQ's

Q.No.	Answer	Reason
1.	(b) Neopentane	Image Structure
2.	(c) Carbocation	Image Structure
3.	(c) Hydrogen peroxide	$H_2C-CH=CH_2+HBr \xrightarrow[Peroxide]{Hydrogen} H_2C-CH_2-CH_2-Br$ (1 – Bromopropane)
4.	(b) Free radical substitution	Step I $Cl-Cl \xrightarrow{h\nu} Cl^{\cdot}+Cl^{\cdot}$ (Initiation) Step II $CH_4+Cl^{\cdot} \xrightarrow{h\nu} CH_3^{\cdot}+HCl$ (Propagation) $^{\cdot}CH_3+Cl-Cl \xrightarrow{h\nu} CH_3Cl+Cl^{\cdot}$ Step III $^{\cdot}CH_3+Cl^{\cdot} \xrightarrow{h\nu} CH_3-Cl$ (Termination)
5.	(c) Addition reaction	Alkene are unsaturated (have double bond) so they preferably give addition reaction rather than substitution reaction.
6.	(c) OH^-	(i) It gives electron easily. (ii) It is more basic than others and react readily with metal ions (electrophiles) and forms base.
7.	(d) $C_6H_5CH^+C_6H_5$	Because in this case, the +ive charge on carbon is more satisfied by the bulky phenyl groups.
8.	(d) $NCCH_2^-$	Due to +ive charge, it readily reacts with Nucleophile.
9.	(a) Detection of unsaturation	Unsaturated compounds discharge the pink colour of $KMnO_4$ while saturated compound cannot discharge colour.
10.	(d) Methane	$3CH_4+4O_2 \longrightarrow 2CO+6H_2O+C$ (Carbon black)
11.	(a) Frankland reaction	$2CH_3-Cl+Zn \longrightarrow ZnCl_2+CH_3-CH_3$ Ethane

12.	(a) 1-Butene	$CH_3-CH_2-CH_2-Cl+KOH \xrightarrow{Alcoholic} CH_3-CH_2-CH=CH_2+CH_2+KCl+H_2O$ (1 – Butene)
13.	(d) Ethyne	(i) $HC(Br)_2-CH(Br)_2 + Zn \longrightarrow HC\equiv CH + ZnBr_2$ (ii) $HC(Br)_2=CH(Br)_2 + Zn \longrightarrow HC\equiv CH + ZnBr_2$
14.	(c) Butanone	$CH_3-C\equiv C-CH_3+H-OH \xrightarrow[H_2SO_4]{HgSO_4} H_3C-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$
15.	(b) Ozonolysis	$\overset{4}{C}H_3-\overset{3}{C}H_2-\overset{2}{C}H=\overset{1}{C}H_2$ gives Propanaldehyde and Formaldehyde $\left(CH_3-CH_2-\overset{O}{\overset{\|}{C}}-H, H-\overset{O}{\overset{\|}{C}}-H\right)$ Respectively while $(CH_3-CH=CH-CH_3)$ gives acetaldehyde.
16.	(b) Electrolysis of sodium acetate	$2CH_3-\overset{O}{\overset{\|}{C}}-O^-Na^+ + 2H_2O \xrightarrow{Electrolysis} CH_3-CH_3+2CO_2+2NaOH+H_2$
17.	(d) Methane	$CO+2H_2 \xrightarrow[450°C,\ 200atm]{ZnO+Cr_2O_3} CH_3OH$ $CH_3OH+H_2 \xrightarrow{Reduction} CH_4+H_2O$ (Methane)
18.	(d) Passing C_2H_5OH vapours over hot Al_2O_3	$CH_3CH_2OH \xrightarrow[300°C]{Al_2O_3} CH_2=CH_2+H_2O$
19.	(a) Ammoniacal cuprous chloride	$HC\equiv CH + Cu_2Cl_2 + 2NH_4OH \longrightarrow CuC\equiv CCu + 2NH_4Cl + 2H_2O$ Dicopperacetylide (Reddish brown ppt.)
20.	(d) None of these	Ethyne C_2H_2 is used for welding purposes.
21.	(d) Butadiene	$H_2C=HC-HC=CH_2$ or $CH_2=CH=CH-CH_3$ There is alternation of two conjugate double bonds.
22.	(a) Ethyl alcohol	C_2H_5OH
23.	(a) $CH_3CH(Br)CH_3$	2 – Bromopropane

Additional MCQ's

Q.No.	Answer	Reason
1.	(a) C_nH_{2n+2}	$n=1$ CH_4 (Methane), $n=2$ C_2H_6 (Ethane) etc.
2.	(c) symmetrical alkanes	$2RCOO^-Na^+ + 2H_2O \xrightarrow{Electrolysis} R-R+2CO_2+2NaOH+H_2$
3.	(a) CH_4	Electrolytic process is used to prepare symmetrical alkane while CH_4 is unsymmetrical alkane.
4.	(c) Both reductions occur	$H_3C-\overset{O}{\overset{\|}{C}}-CH_3$ (Acetone) $+ 4[H] \xrightarrow{Zn\text{-}Hg/HCl} H_3C-CH_2-CH_3$ (Propane) $+ H_2O$ $H_3C-\overset{O}{\overset{\|}{C}}-H + 4[H] \xrightarrow[200°C]{N_2H_4/KOH} H_3C-CH_3 + H_2O$

Scholar's Academy

5.	(c) is reduced to methylene group	$H_3C-\overset{\overset{O}{\|}}{C}-CH_3 + 4[H] \xrightarrow{Zn\text{-}Hg/HCl} H_3C-CH_2-CH_3 + H_2O$ (Acetone → Propane)
6.	(c) N_2H_4 / KOH	$H_3C-\overset{\overset{O}{\|}}{C}-H + 4[H] \xrightarrow[200°C]{N_2H_4/KOH} H_3C-CH_3 + H_2O$
7.	(d) $C_1 - C_4$	First four members $(CH_4, C_2H_6, C_3H_8, C_4H_{10})$ are colourless, odourless gases.
8.	(b) $C_{15}H_{32}$	Carbon C_{15} to onward in alkanes are waxy solids.
9.	(d) H_2O	Alkanes are non-polar while water (H_2O) is polar. So Alkanes are insoluble in H_2O.
10.	(b) Physical constants increases and solubility decreases	With the increase in carbon number London dispersion forces increases and boiling and melting points increase while due to increase in polarity solubility decreases.
11.	(b) 20° – 30°C	Due to increase in carbon number the intermolecular forces increase so boiling point increases.
12.	(c) both a and b	(i) σ-bond is strong so it is less reactive. (ii) C – C and C – H are non-polar so it is less reactive.
13.	(d) no reaction	Alkanes are least reactive and give the reaction (substitution reaction) at high temperature.
14.	(c) CO_2, H_2O, + Heat	$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O + Heat \quad \Delta H = -891 kJ\ mol^{-1}$
15.	(b) Combustion	$CH_4 + 2O_2 \xrightarrow{Flame} CO_2 + H_2O + 891 kJ\ mol^{-1}$
16.	(b) To prepare higher fatty acids.	Palmitic acid, Hexanoic acid, oleic acid etc.
17.	(d) Both a & c	They are used as fuel as well as solvent.
18.	(b) amount of halogen used	Greater the amount, greater will be the extent of reaction and vice versa.
19.	(b) $F_2 > Cl_2 > Br_2 > I_2$	F_2 reacts vigorously, and then Cl_2 and Br_2 react moderately while I_2 is least reactive.
20.	(d) 120 kJ mol^{-1}	$CH_2 = CH_2 + H_2 \xrightarrow[200°C]{Ni} CH_3 - CH_3 \ \Delta H = -120 kJ\ mol^{-1}$
21.	(b) Alkenes	Olefins (olefiant) means oil former. $CH_2 = CH_2 + HCl \longrightarrow CH_3 - CH_2 - Cl$ It is oily in nature so Alkenes are called olefins.
22.	(c) C_5H_{12}	In Alkene ($C_5 - C_{15}$) pentene to pentadecene are liquid.
23.	(a) 20% H_2SO_4	Ter. Alcohols are more reactive.
24.	(d) I_2	Iodine is least reactive ($F_2 > Cl_2 > Br_2 > I_2$). So it does not react with Alkene.
25.	(b) Hyponaious acid	HOX
26.	(d) Both a & c	When Bayer's reagent (1% alkaline dil. $KMnO_4$) react with alkene (double bond) its colour discharges.
27.	(b) O_2	$nCH_2 = CH_2 \xrightarrow[O_2(0.1\%)]{300°C, 1500 atm} \{-CH_2-CH_2-\}_n$
28.	(d) Both a & c	Good quality of polythene is obtained by polymerization of ethene in presence of $Al(C_2H_5)_3$ or $TiCl_4$.
29.	(a) ß – ß' – dichloroethylsulphide.	$2CH_2 = CH_2 + S_2Cl_2 \longrightarrow S(CH_2-CH_2-Cl)_2 + S$
30.	(d) Four	C_2H_6 (Ethane), C_2H_2 (Ethyne) C_2H_2 has Hydrogen less than C_2H_6

31.	(c) Active metals	Active metals are Zn, Mg etc.
32.	(c) $CaC_2 + H_2O$	$CaO + 3C \xrightarrow{2000°C} CaC_2 + CO$ $Ca(C\equiv C) + 2H_2O \longrightarrow Ca(OH)_2 + HC \equiv CH$ (Calcium carbide → Ethyne)
33.	(b) Garlic like	Among alkynes, acetylene has garlic like odour.
34.	(d) All of these	Due to triple bond, bond length (C – C) is short (120 pm) and π – bonds are less diffused so alkyne is less reactive.
35.	(a) CCl_4	$HC \equiv CH + H - Br \longrightarrow H_2C = CH_2 - Br$ (Vinyl Bromide) $H_2C = CH - Br = HBr \xrightarrow[Addition]{Markownikov's} CH_3 - CHBr_2$ 1.1. Dibromoethane
36.	(d) Markownikov's Rule	$HC \equiv CH + H - Br \longrightarrow H_2C = CH_2 - Br$ (Vinyl Bromide) $H_2C = CH - Br + HBr \xrightarrow[Addition]{Markownikov's} CH_3 + CHBr_2$ 1.1. Dibromoethane
37.	(a) Acetaldehyde	$CH_3 - CHO$ (Acetaldehyde), $CH_2 = CH - OH$ (Vinyl Alcohol) Both have same Molecular formula, (C_2H_4O) and different structure and properties.
38.	(c) Acrylonitrile	$CH \equiv CH + HCN \xrightarrow{Cu_2Cl_2, NH_4Cl} CH_2 = CH - CN$ (Acrylonitrile)
39.	(d) $(C_2H_2O_2)$	$HC(=O) - CH(=O)$
40.	(a) Oxyacetylene flame	Use of Ethyne (C_2H_2)
41.	(d) Vinyl acetylene → Chloroprene → Neoprene	Neoprene can be prepared by the polymerization of chloroprene.
42.	(b) Benzene	$3C_2H_2 \xrightarrow[Cu\ Tube]{300°C} C_6H_6$
43.	(a) Reddish Brown ppt	This is used to distinguish alkynes.
44.	(c) Two alkyl group	H, R, C, R
45.	(c) sp	$HC \equiv C - C \equiv CH$ each carbon is attached with two atoms and have (≡) bond so all are sp hybridized.
46.	Pd/C	$CH_3 - CH_2Cl + H_2 \xrightarrow[\Delta]{Pd/C} CH_3 - CH_3 + HCl$
47.	(a) Number of side products	CO_2, H_2 and base form as side product
48.	(b) $-891 kJ\ mol^{-1}$	$CH_4 + 2O_2 \xrightarrow{Flame} CO_2 + H_2O \quad \Delta H = -891 kJ\ mol^{-1}$
49.	(d) Cu	Cu is catalyst in catalytic oxidation of alkane.
50.	(c) 400 – 500°C	$CH_4 + HONO_2 \xrightarrow{450°C} CH_3NO_2 + H_2O$
51.	(c) Carbon black	$3CH_4 + 4O_2 \longrightarrow 2CO + 6H_2O + C$ (Carbon black)
52.	(d) Methane	CH_4
53.	(b) Haloalkanes	(i) Chloromethane (ii) Dichloromethane (iii) Trichloromethane (iv) Tetrachloromethane etc
54.	(b) Urea Fertilizers	$(NH_2)_2CO$
55.	(c) Free radical	It has three steps.

Pratima Academy

Short Answers Questions

1. Why some hydrocarbons are called saturated and others unsaturated. What type of reactions are characteristics of them?

Ans. Saturated Hydrocarbons

"Those hydrocarbons in which the valency of carbon atoms is fully satisfied and no more atom can be added to them are called saturated hydrocarbons."

Examples: Alkanes (CH_4, C_2H_6, C_3H_8 etc.)

Nature of Reactions:

Due to their saturated nature and inertness, saturated hydrocarbons undergo **free radical substitution reactions.**

Unsaturated Hydrocarbons

"Those hydrocarbons in which the valency of carbon atom is not fully satisfied and one or more atoms can be added to them are called unsaturated hydrocarbons.

Examples:

(i) Alkenes (C_2H_4, C_3H_6, C_4H_8 etc)

(ii) Alkynes (C_2H_2, C_3H_4 etc)

Nature of reactions:

Due to their unsaturation, they undergo **electrophilic addition reactions.**

2. Write structural formulas of the following compounds.

(i) iso-butylene (ii) 1,3-Butadiene (iii) Vinylbromide
(iv) But-3-en-1-yne (v) Vinyl acetylene

Ans. Structural Formulas

(i) iso-butylene

$$H_3C-\overset{CH_3}{\overset{|}{C}}=CH_2$$

iso-butylene

(ii) 1,3-Butadiene

$$\overset{1}{C}H_2=\overset{2}{C}H-\overset{3}{C}H=\overset{4}{C}H_2$$

1, 3 - Butadiene

(iii) Vinyl bromide

$$H_2C=CH-Br$$

(Vinyl bromide)

(iv) But-3-en-1-yne

$$HC\equiv C-CH=CH_2$$

But – 3 – en – 1 – yne

(v) Vinyl acetylene

$$CH_2=CH-C\equiv CH$$

(Vinyl acetylene)

3. What do you mean by alkyl groups?

Ans. Alkyl Groups:

"If we remove one hydrogen atom from an alkane, the rest of group is called an alkyl group."

$$\text{alkane} \xrightarrow{-H} \text{alkyl}$$

- It is represented by "– R."
- "– ane" of alkane is replaced by "yl."
- Its general formula is C_nH_{2n+1}.

Examples:

$-CH_3$ (Methyl), $-C_2H_5$ (Ethyl), $-(C_3H_7)$ (Propyl) etc.

ALKANES

4. Justify in alkanes sigma bonds are inert.

Ans. Inertness of σ - bond

In a σ – bond , the electrons are very tightly held between the two nuclei which makes it a very stable bond. A lot of energy is required to break it. Moreover, the electrons present in a σ – bond can neither attack on any electrophile nor a nucleophile can attack on them. Due to the inertness of σ – bonds, alkanes are unreactive.

5. Why alkanes are called paraffins?

Ans. Alkanes are Paraffins

The word "paraffins" is derived from Latin words 'parum' = little, 'affins' = affinity. Alkanes are called paraffins due to:

(i) Non-polar nature:

The **electronegativity values** of carbon **(2.5)** and hydrogen **(2.1)** do not differ appreciably and the bonding electrons between C – H and C – C are equally shared making them almost non-polar. In view of this, the ionic reagents such as acids, alkalies, oxidizing agents, etc. find no reaction site in the alkane molecules to which they could be attached.

(ii) Inertness of σ - bond :

In a σ – bond, the electrons are very tightly held between the nuclei which makes it a very stable bond. A lot of energy is required to break it. Moreover, the electrons present in a σ – bond can neither attack on any electrophile nor a nucleophile can attack on them.

6. How will you prepare methane by decarboxylation reaction?

Ans. Preparation of CH_4 by Decarboxylation

When sodium acetate is heated with soda-lime (prepared by soaking quick lime (CaO) with caustic soda solution and drying the product). It eliminates a molecule of CO_2 to form methane.

$$CH_3-\overset{O}{\overset{\|}{C}}-O\overset{+}{Na} + NaOH \xrightarrow[\Delta]{CaO} CH_4 + Na_2CO_3$$

Sodium Acetate

7. Define hydrogenation. Give its two applications.

Ans. Hydrogenation

"The addition of hydrogen to an unsaturated compound in the presence of a catalyst is called hydrogenation or catalytic hydrogenation."

Catalysts:

The catalysts employed in hydrogenation are Pt, Pd or nickel etc.

Applications:

It is used in the industry as well as in the laboratory:

(i) In industry: It is used for the manufacture of vegetable ghee from vegetable oil.

(ii) In the laboratory: It is used as a synthetic method as well as an analytical tool as the reaction is generally quantitative.

8. Differentiate between hydrogenolysis and hydrogenation.

Ans.

Hydrogenolysis	Hydrogenation
1. The addition of hydrogen accompanied by bond cleavage is called hydrogenolysis."	1. The addition of hydrogen to an unsaturated compound in the presence of a catalyst is called hydrogenation."
2. It is carried out in Pd-charcoal cavity.	2. It is carried out in the presence of Ni, Pt or Pd etc.
3. Examples: (i) $R-X+H-H \xrightarrow[\Delta]{Pd-Charcoal} R-H + HX$ Alkane	3. Examples: (i) $CH_2=CH_2+H_2 \xrightarrow[200°C]{Ni} CH_3-CH_3$ Ethene Ethane

bhatti

(i) $CH_3-Cl+H-H \xrightarrow[\Delta]{Pd-Charcoal} CH_4 + HCl$	(ii) Vegetable oil $+ H_2 \xrightarrow[200°C]{Ni}$ vegetable Ghee

Differentiate between Clemmensen's reduction and Wolfkishner's reduction.

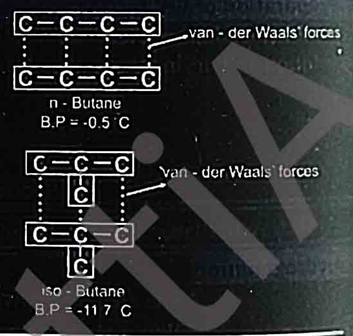
Clemmensen's Reduction	Wolf Kishner's Reduction
1. "The carbonyl compounds (aldehydes and ketones) are reduced to an alkane by using this process."	1. "The carbonyl compounds (aldehydes and ketones) are reduced to an alkane by using this process."
2. The reagent which provides the nascent hydrogen is zinc amalgam and hydrochloric acid (Zn-Hg/HCl).	2. The reagent which provides the nascent hydrogen is hydrazine in the presence of KOH at 200°C.
3. Example: $H_3C-\overset{\overset{O}{\|}}{C}-CH_3 + 4[H] \xrightarrow{Zn\text{-}Hg/HCl} H_3C-CH_2-CH_3 + H_2O$ (Acetone → Propane)	3. Example: $H_3C-\overset{\overset{O}{\|}}{C}-H + 4[H] \xrightarrow[200\,C]{N_2H_4/KOH} H_3C-CH_3 + H_2O$ (Acetaldehyde → Ethane)

10. Why the boiling point of n-butane is greater than iso-butane?
The boiling points of straight chain hydrocarbons are greater than the isomeric branched chain hydrocarbons. Justify.

Ans. Effect of Branching on the Boiling Point of Alkane

The boiling point of a molecule depends upon the strength of intermolecular forces. In alkanes the intermolecular forces are weak **London dispersion forces.**

The boiling point of n-Butane **(b.p. = –0.5°C)** is higher than its isomeric branched chain structure iso-Butane **(b.p. = –11.7°C)** due to two reasons:



(i) Length of Chain:
In n-butane due to longer chain length, the area of interaction between two molecules is large. So it experiences stronger attractive forces than iso-butane which has shorter length.

(ii) Intermolecular Distance:
In n-butane, the molecules are close to each other while in iso-butane, due to branching the distance between the molecules increases. That's why n-butane has strong intermolecular forces than iso-butane.

11. Write down the uses of methane.

Ans. Uses of methane

Methane is used:
(i) as a fuel and as an illuminating gas.
(ii) for the preparation of methylchloride, methylene chloride, chloroform and carbon tetrachloride.
(iii) for the industrial preparation of methyl alcohol, formaldehyde and hydrogen cyanide.
(iv) for the preparation of carbon black used in paints, printing inks and automobile tyres.
(v) is used to manufacture urea fertilizer.

12. How carbon black is prepared? Give its uses.

Ans. Preparation of Carbon Black

When methane is heated in limited supply of oxygen, it gives CO, H_2O and carbon black.

$$3CH_4(g) + 4O_2(g) \xrightarrow{Flame} 2CO(g) + 6H_2O(g) + C(s)$$

Carbon black is used in:
(i) Printing inks
(ii) Automobile tyres
(iii) Paints

13. Convert: $CH_4 \longrightarrow CH_3-CH_3$

Ans. Conversion of $CH_4 \longrightarrow CH_3-CH_3$

$$CH_4 + Cl_2 \xrightarrow{Sunlight} CH_3Cl + HCl$$
$$2CH_3Cl + 2Na \xrightarrow{Dry\ ether} CH_3-CH_3 + 2NaCl$$

14. Identify each lettered product: $CH_3CH_2OH \xrightarrow{PCl_5} A \xrightarrow{Na/ether} B$

Ans.

(i) $CH_3CH_2OH \xrightarrow{PCl_5} A$

$CH_3CH_2OH + PCl_5 \longrightarrow CH_3CH_2Cl + HCl + POCl_3$

(Ethyl chloride)

(ii) $CH_3CH_2Cl \xrightarrow{Na/Ether} B$

$2CH_3CH_2Cl + 2Na \xrightarrow{Ether} CH_3-CH_2-CH_2-CH_3 + 2NaCl$

(n – Butane)

So, A = Ethyl chloride
B = n-Butane

15. How will you bring about the following conversions?
(a) Acetic acid to ethane (b) l-propanol to $CH_3-CH_2-CH_2-Cl$

Ans.

(a) Acetic acid to ethane:

$$CH_3COOH + NaOH \longrightarrow CH_3COO^-Na^+ + H_2O$$
(Acetic acid) (Sod. acetate)

$$2CH_3COO^-Na^+ + 2H_2O \xrightarrow{Electrolysis} CH_3\text{-}CH_3 + 2NaOH + 2CO_2\uparrow + 2H_2\uparrow$$
Ethane

(b) l-Propanol to $CH_3-CH_2-CH_2-Cl$:

$$CH_3CH_2CH_2OH + PCl_5 \longrightarrow CH_3CH_2CH_2Cl + HCl + POCl_3$$

ALKENES

16. Why Alkenes are called olefins?

Ans. Olefins — Alkenes

The word "olefin" is derived from Latin word **olefiant** meaning **oil forming.** This is because alkenes (lower members) give alkyl halides (having oily nature) on treatment with chlorine and bromine.

17. What are monoenes and dienes? Give one example of each.

Ans. Monoenes

"Those alkenes which have one double bond in their structure are called monoenes."
They have general formula C_nH_{2n}.
Examples: $CH_3-CH=CH_2$ (Propene), $CH_2=CH-CH_2-CH_3$ (1 – Butene)

Dienes

"Those alkenes which have two double bonds in their structure are called dienes."
They have general formula C_nH_{2n-2}.

Punjab Academy

Examples:

$\overset{5}{C}-\overset{4}{C}H=\overset{3}{C}H-\overset{2}{C}H=\overset{1}{C}H_2$ — 1,3 - Pentadiene

$\overset{1}{C}H_2=\overset{2}{C}H-\overset{3}{C}H=\overset{4}{C}H_2$ — 1, 3 - Butadiene

18. How would you prepare cis-alkene by partial hydrogenation of alkyne?
Q How will you convert 2-Butyne into cis-2-Butene?

Ans. Formation of cis Alkene by Alkyne

Controlled hydrogenation of 2-Butyne with hydrogen gas in an equimolar ratio over heated catalysts, gives cis 2-Butene. The catalyst is finely divided palladium supported on $BaSO_4$ and poisoned by treatment with quinoline (Lindlar's catalyst).

$$CH_3-C\equiv C-CH_3 + H_2 \xrightarrow[\text{Quinoline}]{\text{Pd (BaSO)}_4} \underset{\text{cis 2 – Butene}}{\overset{CH_3}{\overset{|}{C}}=\overset{CH_3}{\overset{|}{C}}\ (H,H)}$$

2 – Butyne

19. How would you convert alkyne into trans alkene?

Ans. Formation of Trans-Alkene

A trans alkene can be obtained by treating an alkyne with Na in liquid NH_3 at -33°C.

$$R-C\equiv C-R + 2[H] \xrightarrow[-33°C]{\text{Na/liquid.NH}_3} \underset{\text{trans - Alkene}}{\overset{H}{\overset{|}{C}}=\overset{R}{\overset{|}{C}}\ (R,H)}$$

20. Give general mechanism of electrophilic addition reactions of alkene.

Ans. General Mechanism of Electrophilic Addition Reactions of Alkene

It involves three steps:

Step 1: To Generate electrophile

The reagent E – Nu ionizes to give an electrophile and nucleophile.

$$E-Nu \longrightarrow E^+ + :Nu^-$$

Step 2: Attack of electrophile and formation of carbonium ion

The electrophile attacks the carbon – carbon double bond and forms a covalent bond with one carbon and other carbon bears positive charge. As a result a carbocation is formed.

$$E^+ + \underset{\text{Alkene}}{C=C} \xrightarrow{\text{Slow}} \underset{\text{Carbocation}}{C-\overset{+}{C}\ (E)}$$

Step 3: Attack of nucleophile

The nucleophile now attacks the carbocation to form an addition product.

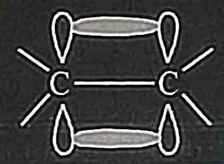
$$\underset{\text{Carbocation}}{C-\overset{+}{C}\ (E)} + :Nu^- \xrightarrow{\text{Fast}} \underset{\text{Addition product}}{C-C\ (E,Nu)}$$

Since the reaction is initiated by addition of electrophile, so it is called electrophilic addition reaction.

21. Why alkenes are more reactive than alkanes?

Ans. Non-reactivity of Alkanes

In alkenes, **π - bond** is present, which is formed by the parallel overlapping of partially filled p-orbitals. The probability of finding electron is thus away from the line joining the two nuclei. Due to this reason, π – bond is a weak bond as compared to σ - bond as π – electrons are less firmly held between nuclei. During a reaction, π – bond breaks comparatively easily and the loosely held π – electrons are more exposed by the electrophilic reagents.



On the other hand, alkanes are non-reactive due to the **non-polarity** of the bonds forming them and the **inertness of σ - bond.**

22. What is Raney Nickel? What is its use?

Ans. Raney Nickel

"Raney nickel is a granular spongy form of nickel. It has porous surface."

Preparation:

Raney nickel is prepared by treating a Ni-Al alloy with caustic soda.

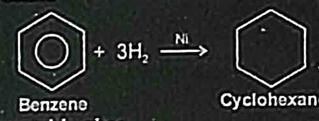
$$Ni-Al+NaOH+H_2O \longrightarrow Ni+NaAlO_2+3/2H_2$$

Use:

Due to large surface area, raney nickel is an effective catalyst and increases the rate of reaction.

(i) Most alkenes are hydrogenated at low temperature (100°C) and low pressure (upto 3atm) by it.

$$\underset{\text{3-Methyl-1-butene}}{H_3C-\overset{CH_3}{\overset{|}{C}}H-CH=CH_2} + H_2 \xrightarrow{Ni} \underset{\text{iso - Pentane}}{CH_3-\overset{CH_3}{\overset{|}{C}}H-CH_2-CH_3}$$



(ii) It is used to convert vegetable oil into vegetable ghee.

$$\text{Vegetable Oil} + H_2 \xrightarrow{Ni} \text{Vegetable ghee}$$

23. What is Markownikov's rule? Give example also.

Ans. Markownikov's Rule

Statement:

"In the addition of an unsymmetrical reagent to an unsymmetrical alkene, the negative part of the adding reagent goes to that carbon, constituting the double bond, which has least number of hydrogen atoms."

Example:

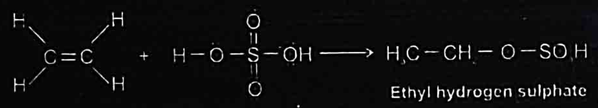
$$\underset{\text{Propene}}{H_3C-CH=CH_2} + HBr \longrightarrow \begin{cases} \xrightarrow{} \underset{\text{1-Bromopropane (not formed)}}{H_3C-CH_2-\overset{Br}{\overset{|}{C}}H_2} \\ \xrightarrow{} \underset{\text{2-Bromopropane (Actual product)}}{H_3C-\overset{Br}{\overset{|}{C}}H-CH_3} \end{cases}$$

24. How would you convert ethene into ethyl alcohol?

Ans. Conversion of Ethene into Ethyl Alcohol

When ethene is treated with cold concentrated sulphuric acid, it is dissolved because it forms ethyl hydrogen sulphate.

bhattiAcademy



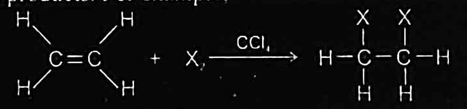
The ethylhydrogen sulphate on boiling with water decomposes to give ethyl alcohol.

$$H_3C-CH_2-O-SO_3H + H_2O \xrightarrow{100^\circ C} H_3C-CH_2-OH + H_2SO_4$$

25. Write down reaction of alkenes with halogens in an inert solvent.

Ans. Addition of halogens with alkenes

The alkenes on treatment with halogen in an inert solvent like carbon tetrachloride at room temperature give vicinal dihalides or 1,2 dihalogenated products. For example,



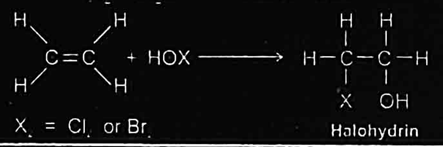
Br_2 and Cl_2 are effective electrophilic reagents. Fluorine is too reactive to control the reaction. Iodine does not react.

26. Write down reaction of alkenes with halogens in reactive solvent.

Ans. Reaction of Alkenes with Halogens In reactive solvents

If the halogenation of an alkene is carried out in an aqueous solution, haloalcohol is formed called a Halohydrin.In this reaction, molecules of the solvent become reactants too.

$$X_2 + H_2O \longrightarrow HOX + HX$$



27. How vicinal Glycol is prepared from ethene?

Q. How can you distinguish chemically unsaturation in alkenes?

Ans. Baeyer's Test

- Dilute 1% alkaline $KMnO_4$ solution is called Baeyer's reagent.
- It is pink in colour and acts as mild oxidizing agent.
- Baeyer's reagent is used to test the presence of unsaturation in the molecules.

Reaction:

When alkenes are treated with Baeyer's reagent at low temperature, hydroxylation of double bond occurs resulting in the formation of dihydroxy compounds known as vicinal glycols. The pink colour of $KMnO_4$ is discharged during the reaction.

$$3H_2C=CH_2 + 2KMnO_4 + 4H_2O \xrightarrow{\text{Cold}} 3\,H_2C(OH)-CH_2(OH) + 2MnO_2 + 2KOH$$

Ethylene glycol

28. What is ozonolysis? Describe it giving example.

OR Give the reaction of ozone with ethene. Also give its mechanism.

Ans. Ozonolysis

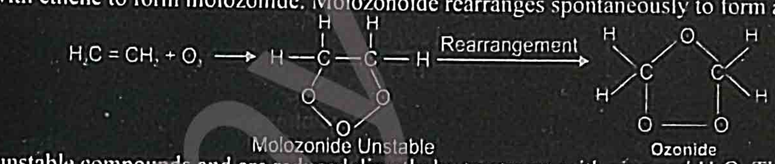
"The cleavage of an unsaturated molecule by reacting with ozone is called ozonolysis."

Ozone (O_3) is a highly reactive allotropic form of oxygen. It reacts vigorously with ethene (or other alkenes) to form formaldehyde (or other **carbonyl compounds.)**

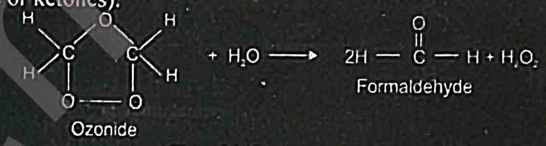
$$CH_2=CH_2 + O_3 \xrightarrow{Zn} 2HCHO$$

Mechanism:

(i) Ozone reacts with ethene to form molozonide. Molozonoide rearranges spontaneously to form an ozonide.



(ii) Ozonides are unstable compounds and are reduced directly by treatment with zinc and H_2O. The reduction produces carbonyl compounds (aldehydes or ketones).

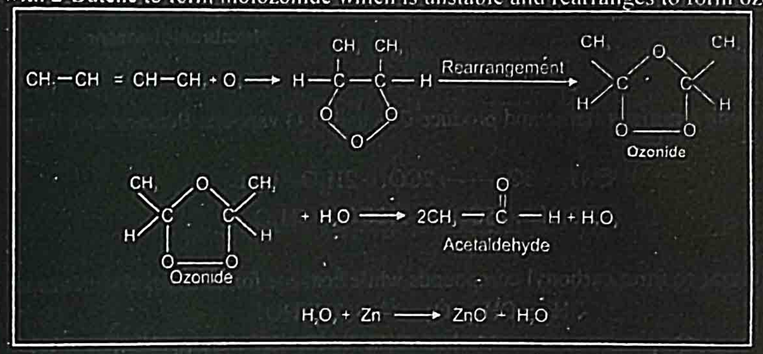


$$Zn + H_2O_2 \longrightarrow ZnO + H_2O$$

29. Which product is formed by ozonolysis of 2-Butene?

Ans. Ozonolysis of 2-Butene

Ozone reacts with 2-Butene to form molozonide which is unstable and rearranges to form ozonide.



$$H_2O_2 + Zn \longrightarrow ZnO + H_2O$$

30. Define polymerization. Write equation for polymerization of ethene.

Ans. Polymerization

"The process in which small organic molecules (monomers) combines together to form larger molecules known as polymers, is called polymerization."

Polymerization of Ethene:

Ethene at 400°C and 100 atm pressure, polymerizes to polythene or polyethylene.

$$n\,CH_2=CH_2 \xrightarrow[\text{100 atm pressure}\ \text{traces of } O_2\ (0.1\%)]{400^\circ C} \text{Polyethylene}$$

A good quality polythene is obtained, when ethene is polymerized in the presence of aluminium triethyl $Al(C_2H_5)_3$ and titanium tetrachloride catalysts ($TiCl_4$). (Ziegler and Nata catalysts)

31. What types of reactions alkenes and benzene have common? Give examples.

Ans. Common Reactions of Alkenes and Benzene

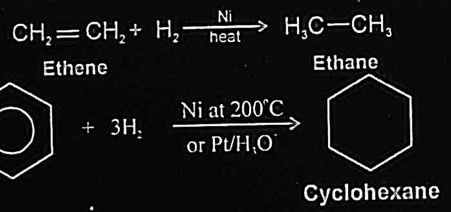
Both alkenes and benzene have two types of reactions in common:

(i) Addition Reactions:

(a) Reduction:

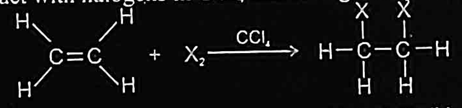
Both alkenes and benzene react with hydrogen in the presence of Ni at 200°C to form alkanes and cycloalkanes respectively.

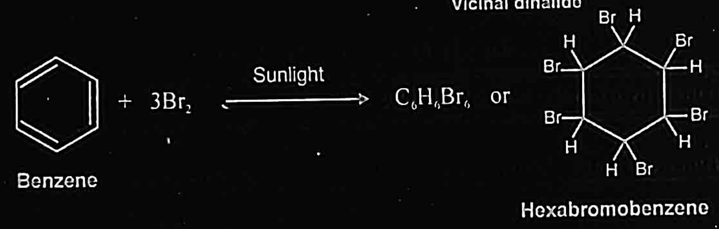
bhattiAcademy



(b) Halogenation:

Both alkenes and benzene react with halogens in CCl_4 and sunlight respectively.





(ii) Oxidation Reactions:

(a) Combustion:

Alkenes burn in air with luminous flame and produce CO_2 and H_2O vapours. Benzene also forms CO_2 and H_2O in free supply of air.

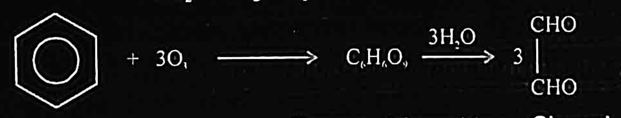
$$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O + \text{heat}$$

$$2C_6H_6 + 15O_2 \longrightarrow 12CO_2 + 6H_2O$$

(b) Ozonolysis:

Ethene reacts with ozone to form carbonyl compounds while benzene forms Glyoxal with ozone.

$$CH_2 = CH_2 + O_3 \xrightarrow{Zn} 2HCHO$$



32. Write down the uses of ethene.

Ans. Uses of ethene

Ethene is used:

(i) for the manufacture of polythene, a plastic material used for making toys, cables, bags, boxes, etc.

(ii) for artificial ripening of the fruits.

(iii) as a general anaesthetic.

(iv) for preparing 'Mustard gas' a chemical used in World War I. The name comes from its mustard like odour. It is not a gas, but a high boiling liquid that is dispersed as a mist of tiny droplets. It is a powerful vesicant i.e., causes blisters.

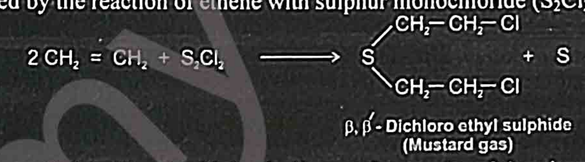


(v) as a starting material for a large number of chemicals of industrial use such as glycols (antifreeze), ethyl halide, ethyl alcohol, etc.

33. How is mustard gas prepared? Give its use.

Ans. Mustard Gas

Mustard gas is prepared by the reaction of ethene with sulphur monochloride (S_2Cl_2).



- Mustard gas is not a gas but a high boiling liquid that is dispersed as a mist of tiny droplets.
- The name comes from its mustard like odour.

Uses:

- Mustard gas is a chemical used in world war-I.
- It is a powerful vesicant i.e., causes blisters. (Blistering agent)

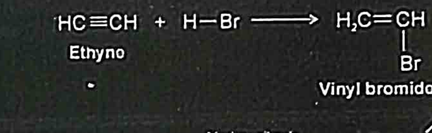
ALKYNES

34. How does ethyne react with halogen acid and alkaline $KMnO_4$?

Ans. Reactions of Ethyne with

(i) Halogen acid:

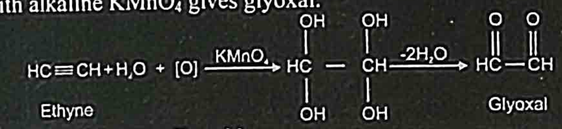
Ethyne reacts with halogen acid (HCl or HBr) to form dihalo-alkanes. The reaction occurs in accordance with Markownikov's rule:



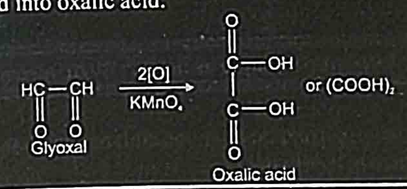


(ii) Alkaline $KMnO_4$:

Ethyne on oxidation with alkaline $KMnO_4$ gives glyoxal.



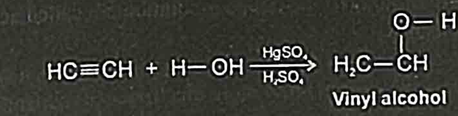
On further reaction, glyoxal is converted into oxalic acid.



35. How acetaldehyde is prepared by ethyne?

Ans. Preparation of Acetaldehyde by ethyne

When water is added to ethyne in the presence of (0.1 %) mercuric sulphate dissolved in (10 %) sulphuric acid at 75°C, vinyl alcohol is formed:



Vinyl alcohol isomerises to acetaldehyde.

bhattiAcademy

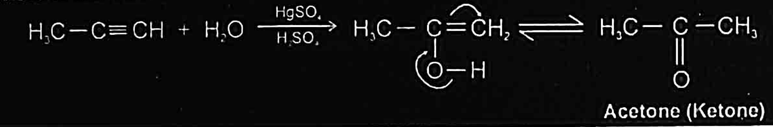


Acetaldehyde

36. How acetone is prepared by propyne?

Ans. Preparation of Acetone by propyne

Propyne reacts with water in the presence of mercuric sulphate dissolved in sulphuric acid at 75°C to form alcohol which isomerises to acetone.

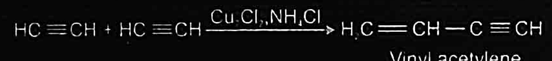


Acetone (Ketone)

37. How acetylene can be converted into chloroprene? Give equation.

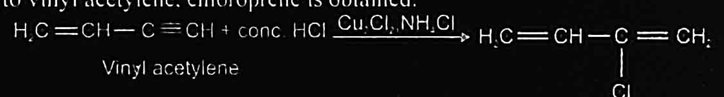
Ans. Conversion of Acetylene to Chloroprene

When acetylene is passed through an acidic solution of cuprous chloride and ammonium chloride and then allowed to stand for several hours at room temperature, vinyl acetylene is formed.



Vinyl acetylene
(1-Buten-3-yne)

If HCl is added to vinyl acetylene, chloroprene is obtained.

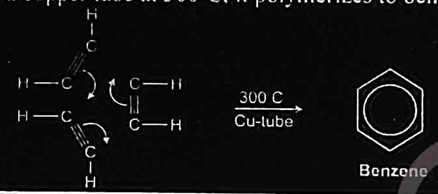


Chloroprene

38. Give equation with conditions of reaction to show cyclic polymerization of acetylene.
Q Benzene can be prepared commercially from acetylene. Give reaction with conditions.

Ans. Cyclic Polymerization of Acetylene

When acetylene is passed through a copper tube at 300°C, it polymerizes to benzene.



Benzene

39. What are terminal alkynes? Why they behave as acids? Write a reaction of propyne with sodium.

Ans. Terminal Alkynes

"The alkynes having triple bond at one end or at carbon-1 are called terminal alkynes or 1-Alkynes."

Examples:

$HC \equiv CH$, $HC \equiv C - CH_3$, $HC \equiv C - CH_2 - CH_3$, $HC \equiv C - CH_2 - CH_2 - CH_3$

Acetylene, Propyne, 1-Butyne, 1 – Pentyne

Acids:

Those species which donate proton (H^+) in aqueous solution are called acids.

Acidic Nature of Terminal Alkynes:

In terminal alkynes, the hydrogen atom is bonded to the carbon atom in sp-s overlap. An sp hybrid carbon atom has 50% s-character in it and renders the carbon atom more electronegative than sp^2 and sp^3 hybridized carbons. As a result, the sp hybridized carbon atom of a terminal alkyne pulls the electrons more strongly, making the attached hydrogen atom slightly acidic.

Reaction of Propyne with Sodium:

Propyne reacts with molten sodium to form propynide.

$$2CH_3 - C \equiv CH + 2Na \longrightarrow CH_3 - C \equiv C^-Na^+$$

Sodium Propynide

40. How ammoniacal solution of $AgNO_3$ can be used to distinguish between 1-Butyne and 2- Butyne?

Ans.

1-Butyne	2-Butyne
1- Butyne reacts with ammoniacal $AgNO_3$ solution (Tollen's reagent) to form white ppt. of disilver butynide.	2-Butyne does not react with Tollen's reagent (Ammoniacal $AgNO_3$ solution).
$CH_3 - CH_2 - C \equiv CH + AgNO_3 + NH_4OH \longrightarrow$ $CH_3 - CH_2 - C \equiv C\,Ag + NH_4NO_3 + H_2O$ disilver butynide (White ppt.)	$CH_3 - C \equiv C - CH_3 + AnNO_3 + NH_4OH \rightarrow$ No reaction

41. How will you distinguish between Ethene and Ethyne?

Ans.

Ethene	Ethyne
1. Ethene does not react with ammoniacal cuprous chloride solution. $H_2C = CH_2 + Cu_2Cl_2 + NH_4Cl \rightarrow$ No reaction	1. Ethyne reacts with ammoniacal solution of Cu_2Cl_2 and yields reddish brown ppt. of dicopper acetylide. $HC \equiv CH + Cu_2Cl_2 + 2NH_4OH \longrightarrow CuC \equiv CCu + 2NH_4Cl + 2H_2O$ dicopper acetylide (Reddish brown ppt.)
2. Ethene does not react with ammoniacal solution of $AgNO_3$ (Tollens's reagent). $H_2C = CH_2 + AgNO_3 + NH_4OH \rightarrow$ No raction	2. Ethyne reacts with Tollen's reagent to form white ppt. of disilver acetylide. $HC \equiv CH + 2AgNO_3 + 2NH_4OH \longrightarrow AgC \equiv CAg + 2NH_4NO_3 + 2H_2O$ Disilver acetylide (white ppt.)

42. Why the bond length between two carbon atoms is shorter in ethyne as compared to ethene? Draw diagrams to show overlapping of orbitals in them.

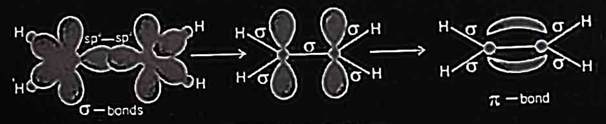
Ans. Shorter bond length of ethyne than ethene

In ethyne, the carbon atoms are held together by a triple bond, a σ – bond and two π-bonds. The electron density between the carbon atoms is very high which draws atoms very close to each other. As a result the bond length decreases. Moreover, the sp-s overlapping decreases the bond length in ethyne.

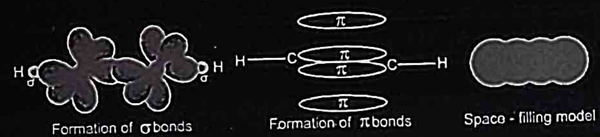
In ethene, carbon atoms are held together by a double bond (a σ – bond and a π-bond). The electron density between carbon atoms is less so, the bond length is greater.

That's why the C – C bond length is shorter in ethyne (120pm) than that of ethene (134pm). The overlapping of orbitals in ethene and ethyne is given below:

bhattiAcademy



Formation of ethene



Formation of ethyne

43. What is meant by vulcanization?

Ans. Vulcanization

"A process in which rubber is made harden by adding sulphur is called vulcanization."

- This process is first introduced by **Charles Goodyear.**

44. In the following reactions, identify each lettered product:

Ethyl Alcohol $\xrightarrow{Conc.H_2SO_4}$ A $\xrightarrow{Br_2}$ B $\xrightarrow{Alcoholic\ KOH}$

Ans.

Ethyl Alcohol $\xrightarrow{Conc.H_2SO_4}$ A

$$CH_3-CH_2-OH \xrightarrow[140-170°C]{Conc.H_2SO_4} CH_2=CH_2+H_2O$$

$$CH_2=CH_2+Br_2 \xrightarrow{CCl_4} \underset{Br}{CH_2}-\underset{Br}{CH_2}$$

1,2-Dibromoethane

$$\underset{Br}{CH_2}-\underset{Br}{CH_2}+KOH \xrightarrow[80°C]{Alcohol} CH_2=\underset{Br}{CH}+KBr+H_2O$$

(Vinyl bromide)

$$CH_2=\underset{Br}{CH_2}+KOH \xrightarrow[150°C]{Alcohol} CH\equiv CH+KBr+H_2O$$

(Ethyne)

****

bhattiAcademy

CHAPTER 9

AROMATIC HYDROCARBONS

Solved Objective Exercise

Q1. Fill in the blanks.

(i). The term aromatic was derived from Greek word _____ meaning _____.
(ii). Aromatic hydrocarbons include benzene and all those compounds which are _____ related to benzene.
(iii). _____ is recognized as the simplest member of the class of Aromatic Hydrocarbons.
(iv). Benzene has _____ structure.
(v). The removal of hydrogen atom from aromatic hydrocarbons gives a radical. The radicals are called _____.
(vi). Benzene was discovered by Michael Faraday in ____
(vii). The unhybridized $2p_z$ orbitals in benzene partially overlap to form a _____ of electron could.
(viii). The introduction of halogen group in benzene ring is called _____.
(ix). The molecular formula of C_6H_6 indicates that it is highly _____ compound.
(x). On oxidation in the presence of V_2O_5 benzene gives _____.

Answer Key.

(i)	aroma, fragrant	(ii)	Structurally
(iii)	benzene	(iv)	regular hexagonal planar
(v)	aryl groups	(vi)	1825
(vii)	continuous sheath	(viii)	Halogenation
(ix)	unsaturated	(x)	maleic anhydride

Q2. Indicate True or false.

(i). Benzene is more reactive than alkene and less reactive than alkane.
(ii). Benzene has a pentagonal structure.
(iii). The C-C bond length in benzene molecule is 1.397 Å.
(iv). The state of hybridization of carbon in benzene molecule is sp^3.
(v). There are six sigma bonds in benzene molecule.
(vi). Halogenonium ion produced in electrophilic substitution reactions is a powerful electrophile.
(vii). In electrophilic substitution reactions, addition products are favourable.
(viii). Sulphonation is carried out when benzene is heated with conc. HNO_3.
(ix). In ozonolysis benzene directly gives glyoxal.
(x). Benzene has five resonance contributing structures.

Answer Key.

(i)	False	(ii)	False	(iii)	True	(iv)	False	(v)	False
(vi)	True	(vii)	False	(viii)	False	(ix)	False	(x)	True

Q. Multiple choice questions. Encircle the correct answer.

(i). The benzene molecule contains
(a) Three double bonds (b) Two double bonds
(c) One double bond (d) Delocalized π - electron charge

(ii). Aromatic hydrocarbons are the derivatives of
(a) normal series of paraffins (b) alkene
(c) benzene (d) cyclohexane

(iii). Which of the following acid can be used as a catalyst in Friedel - Crafts reactions?
(a) $AlCl_3$ (b) HNO_3 (c) $BeCl_2$ (d) NaCl

(iv). Benzene cannot undergo:
(a) substitution reactions (b) addition reactions
(c) oxidation reactions (d) elimination reactions

(v). Amongst the following, the compound that can be most readily sulphonated is:
(a) toluene (b) benzene (c) nitrobenzene (d) chlorobenzene

(vi). During nitration of benzene the active nitrating agent is:
(a) NO_3 (b) NO_2^- (c) NO_2^- (d) HNO_3

(vii). Which compound is the most reactive one:
(a) Benzene (b) ethane (c) ethane (d) ethyne

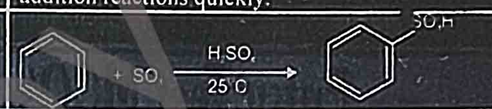
(viii). The electrophile in aromatic sulphonation is:
(a) H_2SO_4 (b) HSO_3 (c) SO_3 (d) SO_3^+

(ix). Aromatic compounds burn with sooty flame because:
(a) They have high percentage of hydrogen (b) They have a ring structure
(c) They have high percentage of carbon (d) They resist reaction with air

(x). The conversion of n-hexane into benzene by heating in the presence of Pt is called:
(a) isomerization (b) aromatization (c) de-alkylation (d) rearrangement

Solved Exercise MCQ's

Q.No.	Answers	Reason
(i).	(d) Delocalized π – electron charge	 Delocalized π-orbital of benzene
(ii).	(c) benzene	
(iii).	(a) $AlCl_3$	
(iv).	(d) Elimination reaction	Benzene gives substitution reactions, oxidation reactions as well as addition reactions. As it is very stable so elimination is not possible.
(v).	(a) Toluene	Toluene is electron donating group and increase the availability of electrons at σ and π – positions. Therefore, the rate of reaction is very high.

(vi).	(b) NO_2^+	NO_2^+ is strong electrophile and attacks on benzene ring first.
(vii).	(b) Ethene	Ethene $(CH_2 = CH_2)$ has more diffused and loosely held π – electrons and gives addition reactions quickly.
(viii).	(c) SO_3	
(ix).	(c) They have high percentage of carbon	$2C_6H_6 + 15O_2 \longrightarrow 12CO_2 + 6H_2O$ + Heat Due to high percentage of carbon they give sooty flame due to unburnt carbon.
(x).	(b) Aromatization	The conversion of Aliphatic compounds into aromatic compounds is aromatization.

Previous Boards MCQ's

1. The extra-ordinary stability of benzene molecule is due to (D.G Khan 2008)
(a) Cyclic structure (b) That it gives addition reactions
(c) Large delocalization of π – electrons (d) That it has three alternate single and double bonds

2. Amongst the following, the compound that can be most readily sulphonated (D.G Khan 2010)
(a) Toluene (b) Benzene (c) Nitrobenzene (d) Chlorobenzene

3. Benzene reacts with alkyl and acyl halides in the presence of $AlCl_3$. This reaction is (Rwp 2008)
(a) Freidel Crafts reaction (b) Aldol condensation
(c) Halogenation reaction (d) Nitration reaction

4. Aromatic compounds give sooty flame because they (Rwp 2009)
(a) Resist the reaction with air (b) Contains high percentage of carbon
(c) Have stable structure (d) Have a cyclic structure

5. In which compound benzene rings are isolated? (Fsd 2008)
(a) Diphenyl methane (b) Naphthalene
(c) Anthracene (d) Phenanthrene

6. Which acid can be used as a catalyst in Friedel-Crafts reactions? (Fsd 2009)
(a) $AlCl_3$ (b) HNO_3 (c) $BeCl_2$ (d) NaCl

7. During nitration of benzene, the active nitrating agent is (Fsd 2010)
(a) NO_3 (b) HNO_3 (c) NO_2^{-1} (d) NO_2^{+1}

8. In benzene the C-C bond length is (Fsd Sup 2010)
(a) $1.395\overset{0}{A}$ (b) $1.296\overset{0}{A}$ (c) $1.397\overset{0}{A}$ (d) $1.398\overset{0}{A}$

9. Benzene cannot undergo (Sgr 2010)
(a) Substitution reactions (b) Addition reactions
(c) Oxidation reactions (d) Elimination reactions

10. The conversion of n- hexane into benzene by heating in the presence of Pt is called (Grw 2008)
(a) Isomerism (b) Aromatization (c) Dealkylation (d) Rearrangement

11. Which compound is the most reactive one? (Grw 2009)
(a) Benzene (b) Ethane (c) Ethane (d) Ethyne

12. Molecule of benzene contains (Grw 2011)
(a) Three double bonds (b) Two double bonds
(c) One double bond (d) Delocalized π – electrons charge

13. Benzene is prepared from cyclohexane by the process called (Lhr 2008)
(a) Hydrogenation (b) Dehydration (c) dehydrogenation (d) None of these

bhattiAcademy

14. Which is the molecular formula of TNT (Lhr 2010)
(a) $C_6H_2(NO_2)_2C_2H_5$ (b) $C_6H_2(NO_2)_3CH_3$ (c) $C_6H_2(NO_2)_3C_2H_5$ (d) $C_6H_2(NO_2)_3C_3H_7$

15. Ortho, para derivatives are obtained by halogenation of (Lhr 2011)
(a) Nitrobenzene (b) Toluene (c) Benzaldehyde (d) Benzene

Entry Test MCQ's

1. Aromatic compounds have_____ in their molecular formula
(a) Low hydrogen to carbon ratio (b) Equal hydrogen to carbon ratio
(c) High hydrogen to carbon ratio (d) Difficult to predict

2. Which of the following functional groups has the correct order of priority while naming derivatives of aromatic hydrocarbons
(a) –OH,-COOH,-CHO (b) –CHO,-COOH,-OH
(c) –OH ,-CHO,-COOH (d) –COOH,-CHO ,-OH

3. Among the following ,the compound that is nitrated with difficulty is
(a) Benzene (b) Toluene (c) Nitrobenzene (d) Phenol

4. Possible number of isomers of xylene is
(a) 2 (b) 3 (c) 4 (d) 5

5. Toluene when treated with Br_2 gives p-bromotoluene as the major product because the CH_3—group is
(a) p-directing (b) activate the ring by hyperconjugation
(c) m-directing (d) deactivate the ring

6. Which of the following group is m-directing group and decreases reactivity of benzene
(a) –OH (b) $-NH_2$ (c) –OR (d) -CHO

7. Benzene ring contains number of sigma bonds and pi electrons
(a) 12 σ bonds and 4π electrons (b) 8 σ bonds and 8π electrons
(c) 10 σ bonds and 6π electrons (d) 12 σ bonds and 6π electrons

8. Which of the monoalkyl substituted benzene gives carboxylic acid on oxidation
(a) Toluene (b) Ethylbenzene (c) Cumene (d) All of these

9. By which of the following ways, structure of benzene can be explained
(a) Resonance method (b) Resonance energy
(c) Atomic orbital treatment (d) All of the above

10. Which of the following statement is incorrect about carbon carbon bond length
(a) In alkanes, the C– C bond length is 1.54 $\overset{0}{A}$ (b) In alkynes the C ≡ C bond length is 1.20 $\overset{0}{A}$
(c) In alkenes, the C= C bond length is 1.30 $\overset{0}{A}$ (d) In benzene the C– C bond length is 1.397 $\overset{0}{A}$

11. Which of the following type of reaction is used for the synthesis of alkyl aromatic hydrocarbons
(a) Wurtz's reaction (b Frankland reaction
(c) Wurtz-Fittig reaction (d) Dow's process

12. Benzene shows five contributing structures. Which of the following are the major contributing structure
(a) Kekule's structure (b) Dewar's structure
(c) both a and b are equal contributing (d) None of the above

13. Benzene reacts with acetyl chloride in the presence of anhydrous aluminium chloride to form:
(a) Acetophenone (b) Chlorobenzene
(c) Phenyl acetate (d) Benzoic acid

14. In the presence of iron catalyst, benzene reacts with chlorine to form:
(a) Chlorobenzene (b) Hexachlorobenzene
(c) Benzene hexachloride (d) None of these

15. The reaction of chlorine with toluene in presence of ferric chloride gives predominantly:
(a) Benzoylchloride (b) Benzylchloride (c) m-chlorotoluene (d) o-and p-chlorotoluene

16. Picric acid is a yellow coloured compound. Its chemical name is:

(a) Trinitrobenzene (b) Trinitrotoluene
(c) 2,4,6-Trinitrophenol (d) Trinitroaniline

17. Which is not an aromatic compound
(a) Pyridine (b) Naphthalene (c) Xylene (d) Cyclohexane

18. Benzene vapours mixed with air when passed over V_2O_5 catalyst at 500°C gives:
(a) Oxalic acid (b) Ethylbenzoate (c) Phenol (d) Maleic anhydride

19. Which of these does not contain -COOH group
(a) Aspirin (b) Acetic acid (c) Benzoic acid (d) Picric acid

20. Heating a mixture of sodium benzoate and sodalime gives
(a) Benzene (b) Sodium benzoate (c) Methane (d) Calcium benzoate

21. Wurtz reaction involves the interaction of alkyl halides in dry ether with
(a) Sodium (b) Copper (c) Zinc (d) Platinum

22. Benzene is a polymer of
(a) Ethyne (b) Ethene (c) Methane (d) Ethane

23. The oxidation of toluene with $KMnO_4$ gives
(a) benzoic acid (b) benzene (c) benzaldehyde (d) chlorobenzene

Additional MCQ's

1. Phenanthrene contains _____ double bonds:
(a) Five (b) Seven (c) Six (d) Two

2. 

is given the name:
(a) Toluene (b) Aniline (c) Phenol (d) Styrene

3. Substituted phenyl groups are called:
(a) Aryl groups (b) Aromatic (c) Alkyl groups (d) Methyl Groups

4. Which of the following does not undergo polymerization:
(a) Alkenes (b) Alkynes (c) Benzene (d) All of them

5. The substitution of hydrogen of an alkane or benzene ring by a halogen atom is
(a) Sulphonation (b) Nitration (c) Oxidation (d) Halogenation

6. The resonance energy of benzene is:
(a) -119.5 kJ/mole (b) -358.5 kJ/mole (c) 150.5 kJ/mole (d) -208 kJ/mole

7. Meta directing group _____ the chemical reactivity of benzene ring:
(a) Increases (b) Does not effect (c) Decreases (d) Promotes

8. On chance basis _____ % ortho, meta and para disubstituted products are expected respectively:
(a) 40%, 20%. 40% (b) 31%, 32%. 33% (c) 20%. 40%. 40% (d) 40%. 40%. 20%

9. Benzene is formed by passing acetylene over an____catalyst at 70°C:
(a) Pt or Pd (b) CaO (c) $Cr_2O_3+Al_2O_3+SiO_2$ (d) Organo-Nickel catalyst

10. Benzene is prepared by aromatization at_____ :
(a) 70°C (b) 500°C (c) 700°C (d) 150°C

11. When benzal chloride react with Cl_2 in the presence of sunlight the product formed is
(a) Benzylchloride (b) Benzotrichloride (c) Benzene (d) Nitrobenzene

12. When benzene is heated with fuming H_2SO_4 product is
(a) Benzaldehyde (b) Benzene
(c) Benzene sulphonic acid (d) Benzoic Acid

13. In side chain oxidation of alkyl benzene _____ is always produced:

bhattiAcademy

(a) CO_2 (b) C_6H_5-COOH (c) C_6H_6 (d) Both a and b

14. **Toluene reacts with nitric acid at 100°C to form:**
(a) 2,6-Dinitrotoluene (b) 2,4,6-Trinitrophenol
(c) 2,4,6-Trinitrotoluene (d) 2,4,6-Dinitrotoluene

15. **Benzene has a regular planar:**
(a) Gonal structure (b) Tretragonal (c) Trigonal (d) Hexagonal

16. **Carbon in benzene is hybridized:**
(a) sp Hybridized (b) sp^2 Hybridized (c) sp^3 Hybridized (d) All of them

17. **The difference between amount of heat actually released and calculated on the basis of Kekule's structure is called:**
(a) Resonane energy (b) Ionization energy
(c) Heat of vapourization (d) Heat of fusion

18. **Which of the following cannot decolourize $KMnO_4$ Solution:**
(a) Ethyne (b) Ethene (c) Propene (d) Benzene

19. **Benzene is reduced to ____ on heating at high temperature with H_2 in the presence of Pt:**
(a) Toluene (b) Cyclohexane (c) Acetophenone (d) Alkyl benzene

20. **The ring is destroyed when benzene is strongly heated with air in presence of:**
(a) Pt (b) Conc.HCl (c) P_2O_5 (d) V_2O_5

21. **The electron releasing effect of methyl group is significant and it makes the ring a good:**
(a) Nucleophile (b) Electrophile
(c) Meta directing group (d) None of them

22. **Ozonolysis of benzene produces:**
(a) Maleic acid (b) Cyclohexane (c) Benzoic acid (d) Glyoxal

23. **Benzene does not undergo polymerization and it is also resistant to:**
(a) Oxidation (b) reduction (c) Halogenation (d) None of them

24. **Those polycyclic compounds in which benzene rings are isolated:**
(a) Biphenyl (b) Phenol (c) Naphthalene (d) Antracene

25. **The empirical formula of benzene is determined by____:**
(a) Quantitative analysis (b) Qualitative analysis
(c) Elemental analysis (d) Both b and c

26. **The stability of benzene can be measured by comparing it with ____:**
(a) 1. 3. 5 – Cyclohexatriene (b) 1,2,5 – Cyclohexatriene
(c) 1. 3. 5 – Cyclohexadiene (d) Both (a) and (c)

27. **The three alternate single and double bonds in the Kekule's structures are called**
(a) Conjugate bonds (b) resonating bonds (c) Double bonds (d) Both a & b

28. **The C-C bond length in benzene is intermediate between those:**
(a) Alkanes and alkenes (b) Alkynes and alkanes
(c) Alkenes and alkynes (d) Both a and c

29. **The molecular formula of benzene corresponds with which of the following open chain hydrocarbons:**
(a) Alkane (b) Alkene (c) Alkyne (d) None

30. **The complete circle inside benzene ring is used to represent:**
(a) 6 bonds (b) Inertness
(c) Only single bonds (d) Resonating double and single bonds

31. **Molecular mass of benezene was determined by:**
(a) Lowering in vapour pressure (b) Elevation in boiling point
(c) Vapour density method (d) Depression in freezing point

32. **Iron converted into FeX_3 reacts with halogen molecule to form which kind of electrophile:**
(a) Powerful electrophile (b) Weak electrophile
(c) Moderate electrophile (d) Powerful Nucleophile

33. **Which of the following is more stable compound:**
(a) Ethene (b) Ethane (c) Benzene (d) Ethyne

34. **To prepare m-chloronitrobenzene from benzene first we do:**
(a) Chlorination (b) Nitration (c) Both at same time (d) Hydrogenation

35. **Benzene does not give substitution reaction with:**
(a) Conc.HNO_3 (b) dil. HNO_3
(c) Conc.H_2SO_4 (d) both a and b

36. **When meta – directing group is attached to ring then electrophile attacks at:**
(a) More electron deficient ortho position (b) More electrons deficient para position
(c) Both a and b (d) Less electrons deficient meta position

37. **When a hydrogen atom is removed from benzene we get:**
(a) Phenyl (b) Alkyl (c) Aniline (d) Cyclohexane

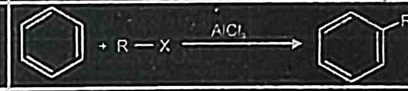
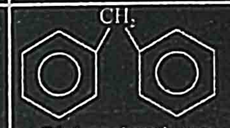
38. **Benzene is stable to____solution:**
(a) H_2SO_4 (b) Al_2O_3 (c) HNO_3 (d) $KMnO_4$

39. **Six positions of C_6H_6 are exactly:**
(a) Equivalent (b) Ortho positions (c) Non-equivalent (d) Meta positions

40. **Naphthalene is an example of:**
(a) Monocyclic Aromatic Hydrocarbon (b) Polycyclic Aromatic Hydrocarbon
(c) Aliphatic Hydrocarbon (d) Alicyclic hydrocarbon

ANSWERS TO MCQ'S

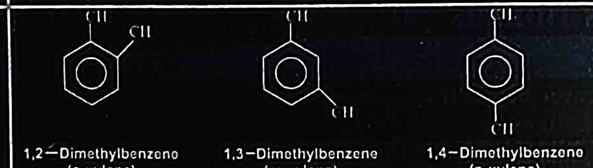
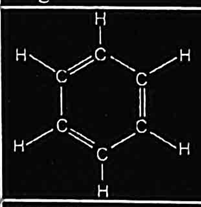
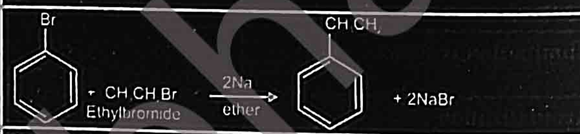
Previous Boards MCQ's

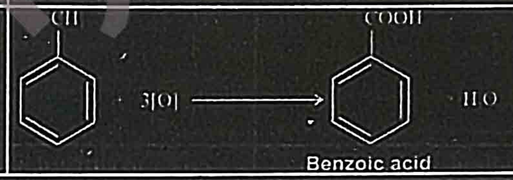
Q.No.	Answers	Reason
1.	**(c) Large delocalization of** π – electrons.	Benzene has 5 Resonating structures i.e. two Kekule's structures and three Dewar's structures.
2.	**(a) Toluene**	Toluene is o, p.– directing group and increases the rate of reaction.
3.	**(a) Freidel crafts reaction.**	
4.	**(b) Contains high percentage of carbon.**	$2C_6H_6 + 15O_2 \rightarrow 12CO_2 + 16H_2O$ + Heat Due to high ratio of carbon sooty particles produced due to unburnt carbon.
5.	**(a) Diphenylmethane**	 Diphenylmethane
6.	**(a) $AlCl_3$**	$AlCl_3$ forms a strong electrophile which can easily attack on benzene ring.
7.	**(d) NO_2^+**	NO_2^+ is strong electrophile & attacks on benzene ring first.
8.	**(c) 1.397 $\overset{0}{A}$**	This is explained by X-rays study.
9.	**(d) Elimination reactions**	Benzene gives substitution, addition as well as oxidation reaction. It cannot undergo substitutions reaction due to high stability.
10.	**(b) Aromatization**	Conversion of aliphatic compounds into aromatic compounds is called aromatization.
11.	**(b) Ethene**	Due to weak π – bond and availability of π – electrons for electrophilic reagent.
12.	**(d) Delocalized π – electron charge**	 Delocalized π-orbital of benzene

khattiAcademy

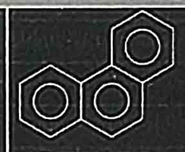
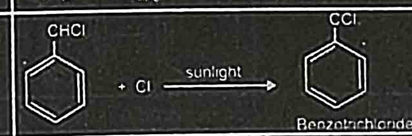
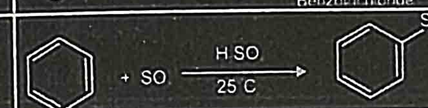
13.	(c) Dehydrogenation	$C_6H_{12} \xrightarrow[250°C]{Pt \text{ or } Pd} C_6H_6 + 3H_2$
14.	(b) $C_6H_2(NO_2)_3CH_3$	2, 4, 6 – Trinitrotoluene
15.	(b) Toluene	As toluene is electron donating group so it increases the availability of electrons at ortho and para positions.

Entry Test MCQ's

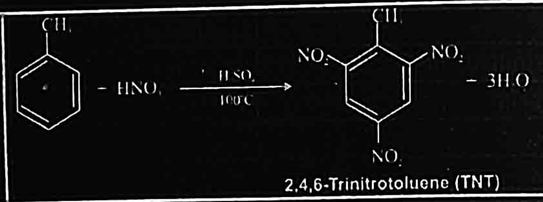
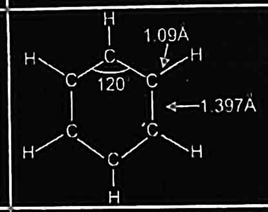
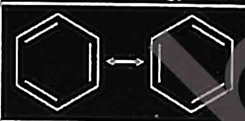
Q.No.	Answers	Reason
1.	(a) Low hydrogen to carbon ratio	(i) Non-aromatic compounds C_2H_6, C_2H_4 has high hydrogen to carbon ratio i.e. 3:1 and 2:1 respectively (ii) Aromatic compound C_6H_6 has 1:1 hydrogen to carbon ratio. It shows that aromatic compounds have low H to C ratio.
2.	(d) – COOH, - CHO, - OH	Priority order: –COOH, -CN, -CHO, -$COCH_3$, - OH, -NH_2, -OR, -R
3.	(c) Nitrobenzene	Nitro group is meta directing group. So it decreases the reactivity of benzene.
4.	(b) 3	
5.	(a) p-directing group	Since – CH_3 is electrons donating group.
6.	(d) – CHO	– CHO is electron withdrawing group and decreases the reactivity of ring.
7.	(d) 12σ bonds and 6π-electrons	
8.	(d) All of the above	Alkyl benzene oxidizes to oxalic acid.
9.	(c) Atomic orbital theory	Hexagonal frame-work of benzene can be conveniently explained by atomic orbital theory.
10.	(c) In alkenes, the C = C bond length is 1.30 Å	Actually in alkenes C = C bond length is 1.34 Å
11.	(c) Wurtz Fittig reaction.	
12.	(a) Kekule's structure	Kekule's structures has almost 80% contribution.
13.	(a) Acetophenone	$CH_3COC_6H_5$
14.	(a) Chlorobenzene	C_6H_5Cl
15.	(d) ortho and para chlorotoluene	Methyl is o and p – directing group.
16.	(c) 2,4,6- Trinitrophenol	Picric acid
17.	(d) Cyclohexane	Cyclohexane has no benzene ring so cyclohexane is not an aromatic

		compound.
18.	(d) Maleic anhydride	Write equation
19.	(d) Picric acid	2, 4, 6 – Trinitrophenol
20.	(a) Benzene	C_6H_6
21.	(a) Sodium	$2CH_3Cl + 2Na \xrightarrow{ether} CH_3 - CH_3 + 2NaCl$
22.	(a) Ethyne	$3C_2H_2 \xrightarrow[Cu\ tube]{red\ hot\ C} C_6H_6$
23.	(a) Benzoic acid	

Additional MCQ's

Q.No.	Answers	Reason
1.	(b) Seven	
2.	(d) Styrene	– CH = CH_2 group is vinyl group and vinyl group attached with benzene is known as styrene.
3.	(a) Aryl group	C_6H_5 – Aryl or phenyl group.
4.	(c) Benzene	It is itself polymer of ethyne.
5.	(d) Halogenation	Halogenation means introduction of halogen.
6.	(c) 150.5 kJ/mol	This shows high stability of benzene.
7.	(c) Decreases	As meta directing group is electrons with drawing group, so it decreases the reactivity of benzene.
8.	(d) 40%, 40%, 20%	There are 2 ortho, 2 meta and 1 para position on benzene.
9.	(d) Organo-Nickel catalyst	$3HC \equiv CH \xrightarrow[70°C]{organo\text{-}nickel\ catalyst}$ 
10.	(b) 500° C	$C_6H_{14} \xrightarrow[500°C]{Cr_2O_3 + Al_2O_3 + SiO_2} C_6H_6 + 4H_2$
11.	(b) Benzotrichloride	
12.	(c) Benzenesulphonic acid	
13.	(b) $C_6H_5 - COOH$	Benzoic acid

bhatiAcademy

14.	(c) 2,4,6 – Trinitrotoluene	 2,4,6-Trinitrotoluene (TNT)
15.	(d) Hexagonal	
16.	(b) sp^2 hybridized	As each C is attached with three other atoms.
17.	(a) Resonance energy	$\Delta H_C = -358.5\,kJmol^{-1}$ Experimental $\Delta H_E = -208.5\,kJmol^{-1}$ Resonance energy $= \Delta H_E - \Delta H_C = -208.5\,kJmol^{-1} - (-358.5\,kJmol^{-1})$ $= 150.5\,kJ\,mol^{-1}$
18.	(d) Benzene	Benzene is highly stable and does not react with $KMnO_4$
19.	(b) Cyclohexane	$C_6H_6 + 3H_2 \xrightarrow[200^\circ C]{Pt} C_6H_{12}$
20.	(d) V_2O_5	Vanedium pentaoxide
21.	(a) Nucleophile	Due to $-CH_3$ the availability of electrons at o – and p – position increases and an electrophile can easily attack on it and ring act as nucleophile.
22.	(d) Glyoxal	 Benzene triozonide Glyoxal
23.	(a) Oxidation	It is not oxidized by $KMnO_4$ but the structure is destroyed by V_2O_5 at 500°C.
24.	(a) Biphenyl	 Biphenyl
25.	(c) Elemental analysis	Elemental analysis is used only for hydrocarbons.
26.	(a) 1,3,5 – Cyclohexatriene	Resonance energy = 150.5 KJ/mol.
27.	(d) Both a and b	
28.	(a) Alkanes and Alkenes	In benzene it is 1.397 A° intermediate b/w 1.54A° or 1.34 A°.
29.	(d) None	C_nH_{2n+2} (Alkane), C_nH_{2n} (Alkene) C_nH_{2n-2} (Alkyne) While benzene has molecular formula C_6H_6 (C_nH_n).
30.	(d) Resonating double and single bonds	 Delocalized π-orbital of benzene

31.	(c) Vapour density method	Mol. mass = 2 × vapour density.
32.	(a) Powerful electrophile	$FeX_3 + X_2 \longrightarrow FeX_4^{-1} + X^{+1}$ Halogenonium ion
33.	(b) Ethane	Due to inertness of σ bond.
34.	(b) Nitration	As nitro group is m – directing group.
35.	(b) dil HNO_3	It gives substitution reaction only with conc. HNO_3 & conc. H_2SO_4.
36.	(d) Less electron deficient m – directing group.	At meta position electrons availability is slightly greater than p and o position. When m – directing group is attached with it so electrophile attack on m – position.
37.	(a) Phenyl	C_6H_5 –
38.	(d) $KMnO_4$	Benzene does not decolourized $KMnO_4$ solution.
39.	(a) Equivalent	All C – C bond lengths and all angles are 1.397 Å and 120° respectively.
40.	(b) Polycyclic aromatic hydrocarbons	

Short Answers Questions

1. What is meant by the term aromatic?

Ans. Aromatic

The term aromatic was derived from the Greek word "aróma" meaning "fragrant" (pleasant odour) and was used in organic chemistry for a special class of organic compounds. These compounds have low hydrogen to carbon ratio (or high carbon to hydrogen ratio) in their molecular formulas and have a characteristic odour. They are called **aromatic compounds.**

2. Aromatic compounds burn with sooty flame. Justify.

Ans. Sooty Flame of Aromatic Compounds

Aromatic compounds have relatively high ratio of carbon to hydrogen. So, when they burn, they give sooty flame. The sooty flame is unburnt carbon particles.

$$2C_6H_6 + 15O_2 \longrightarrow 12CO_2 + 6H_2O$$

1 mole of benzene requires 7.5 moles of oxygen for complete combustion. So, during the burning of aromatic compounds, some carbon remains in unburnt form which appears in the form of sooty flame.

3. What are monocyclic aromatic hydrocarbons? Give two examples.

Ans. Monocyclic Aromatic Hydrocarbons

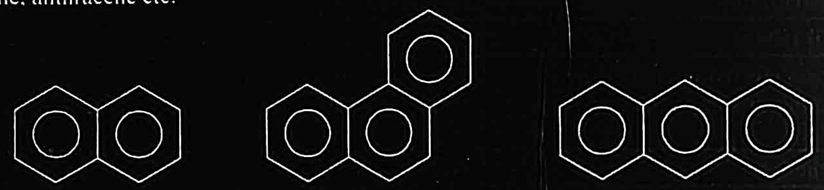
"Aromatic hydrocarbons containing one benzene ring in their molecules are called Monocyclic Aromatic Hydrocarbons", e.g. benzene and its derivatives.



4. What are fused rings aromatic compounds? Give examples.
Q Give two examples of condensed aromatic hydrocarbons.

Ans. Fused rings or Condensed Aromatic Compounds

Those polycyclic aromatic hydrocarbons in which the benzene rings are fused together at ortho positions so that the adjacent rings have a common carbon to carbon bonds are called fused rings or condensed aromatic compounds e.g. naphthalene, phenanthrene, anthracene etc.



Naphthalene Phenanthrene Anthracene

5. What are non-benzenoid aromatic compounds?

Ans. Non-Benzenoid Aromatic Compounds

"Those aromatic compounds which show aromaticity according to Huckle's rule but do not contain benzene ring in their structure are called non-benzenoid aromatic compounds."

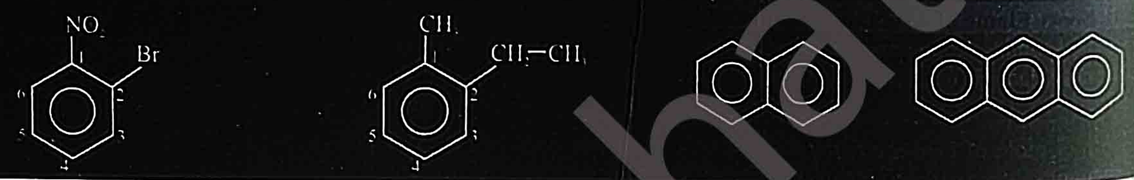
Examples:

Pyridine Furan Pyrrole Thiophene Quinoline

6. Draw the structural formulas of the followings:
(a) σ - Bromonitro benzene (b) σ - Ethyl toluene
(c) Naphthalene (d) Anthracene

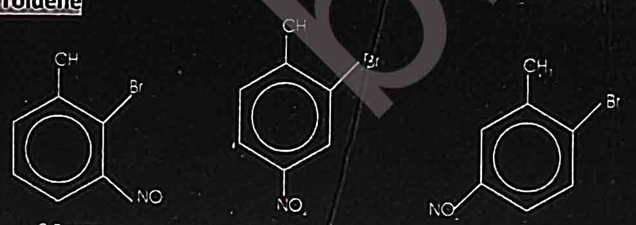
Ans. Structural Formulas of

(a) σ - Bromonitro benzene (b) σ - Ethyl toluene (c) Naphthalene (d) Anthracene

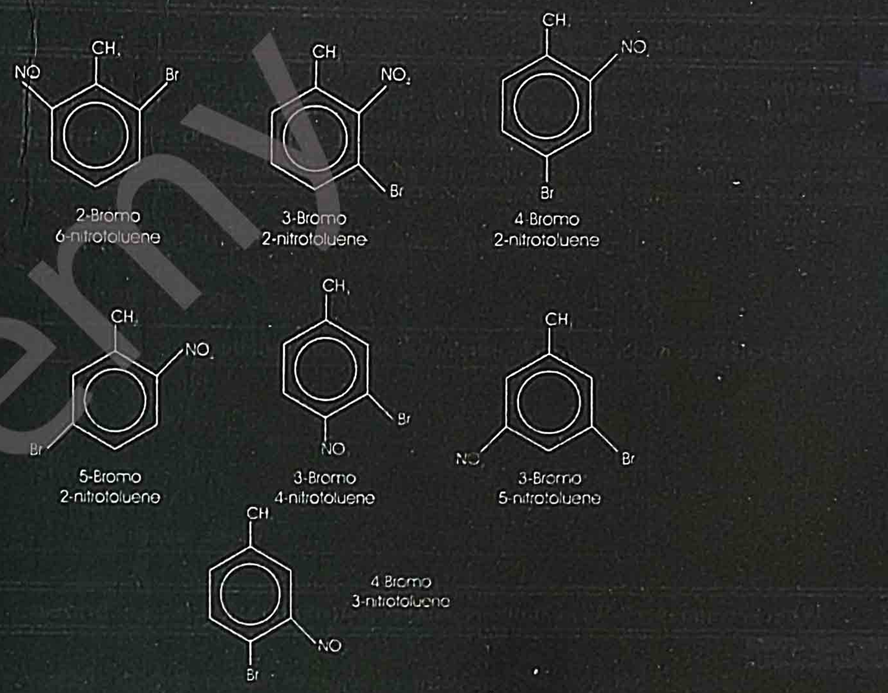


7. Write the names and possible isomeric structures of Bromonitro toluene.

Ans. Isomers of Bromonitro Toluene



2-Bromo 3-nitrotoluene 2-Bromo 4-nitrotoluene 2-Bromo 5-nitrotoluene



2-Bromo 6-nitrotoluene 3-Bromo 2-nitrotoluene 4-Bromo 2-nitrotoluene
5-Bromo 2-nitrotoluene 3-Bromo 4-nitrotoluene 3-Bromo 5-nitrotoluene
4-Bromo 3-nitrotoluene

8. Give two possible straight chain structures proposed for benzene.

Ans. Straight Chain Structures Proposed for Benzene

Two of the possible straight chain formulas suggested for benzene are:

(i) $HC \equiv C - CH_2 - CH_2 - C \equiv CH$, (1, 5 – Hexadiyne)

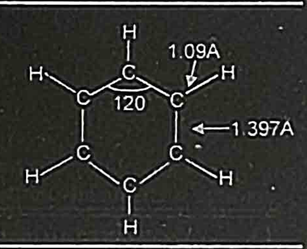
(ii) $H_2C = CH - C \equiv C - CH = CH_2$ (1, 5 – Hexadiene – 3 – yne)

9. What informations are drawn from X-ray studies of Benzene?

Ans. X-ray Studies of Benzene Structure

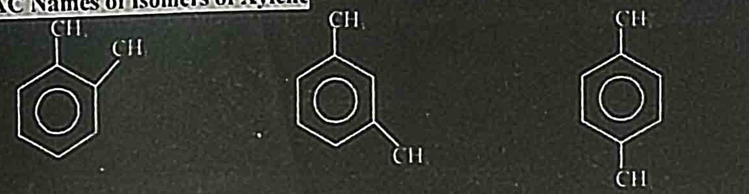
The X-ray studies of benzene have confirmed that:

- Benzene has regular hexagonal structure.
- All the carbon and hydrogen atoms are in the same plane.
- All the angles are of 120^0.
- All C – C bond lengths are 1.397Å
- All C – H bond-lengths are 1.09 Å



10. Write down IUPAC names of o-xylene , p-xylene and m-xylene.

Ans. Structures & IUPAC Names of Isomers of Xylene



1,2 Dimethylbenzene (o-xylene) 1,3 Dimethylbenzene (m-xylene) 1,4 Dimethylbenzene (p-xylene)

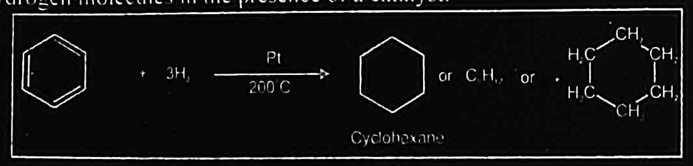
Bhatti Academy

11. Benzene has three π-bonds.

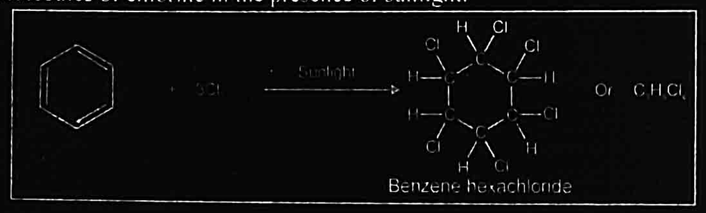
Ans. Benzene ---- three π – Bonds

The molecular formula of benzene is C_6H_6. It shows that benzene molecule is highly unsaturated. Cyclic structure of benzene shows that benzene has three π - bonds alternating three σ – bonds . Experimentally, it is verified as follow:

(i) Benzene adds three hydrogen molecules in the presence of a catalyst.



(ii) Benzene adds three molecules of chlorine in the presence of sunlight.



12. What is resonance? Write down resonance contributing structures of benzene.

Ans. Resonance

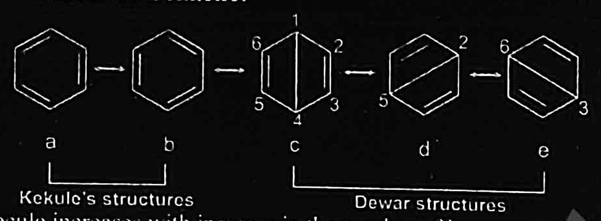
"The possibility of different pairing schemes of valence electrons of atoms is called resonance."

OR

"The situation in which two or more plausible Lewis structures can be written but the actual structure cannot be written is called Resonance."

- The resonance is represented by a **double headed arrow (↔)**.

Resonance Contributing Structures of Benzene:



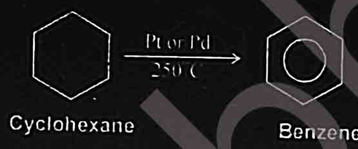
The stability of a molecule increases with increase in the number of its resonance structures. Thus molecule of benzene is chemically quite stable because it has five resonance contributing structures.

13. Write any two methods for the preparation of benzene.

Ans. Preparation of Benzene

(i) Dehydrogenation of Cyclohexane

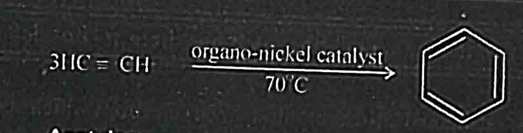
When cyclohexane is dehydrogenated, we get benzene. The reaction is carried out in the presence of catalyst at elevated temperature.



(ii) From Acetylene:

Benzene is formed by passing acetylene under pressure over an organo-nickel catalyst at 70°C or by passing through Cu-tube at 300°C .

bhattiAcademy



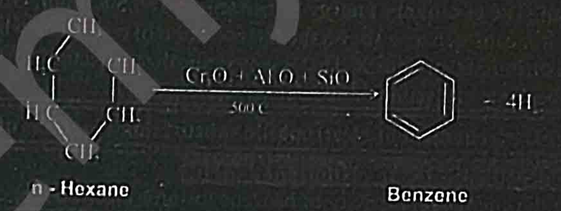
14. What is aromatization? Give examples.

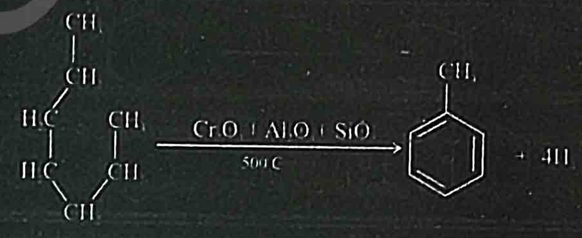
Ans. Aromatization

"The conversion of aliphatic hydrocarbons into aromatic hydrocarbons in the presence of suitable catalyst is called aromatization."

- This process is used to improve **octane number** of gasoline.

Examples:





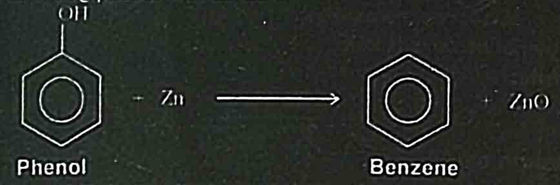
Octane number of n-Heptane is "0" while that of toluene is 104.

15. How will you prepared benzene from: (i) Phenol (ii) Sodium Benzoate

Ans. Preparation of Benzene from

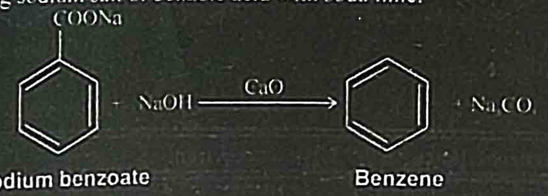
(i) Phenol:

Benzene is prepared by distilling phenol with Zn dust.



(i) Sodium Benzoate:

We get benzene by heating sodium salt of benzoic acid with soda lime.



16. Why Benzene is less reactive than alkenes although it has three π - bonds?

Ans. Reactivity of Benzene

Benzene has regular planar hexagonal structure. It has six π - electrons which show **extensive delocalization** and makes benzene structure highly stable. Due to this, benzene gives substitution reactions preferably and addition reactions reluctantly.

On the other hand, in alkenes the loosely held π-electrons are more exposed to attack by the electrophilic reagents. Alkenes, therefore, undergo electrophilic reactions very easily.

17. How you prove that benzene is a stable molecule?

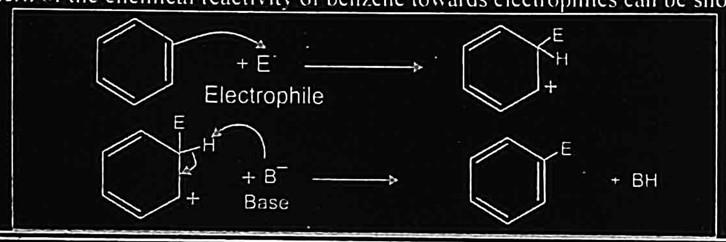
Ans. Stability of Benzene Molecule

Benzene has regular planar hexagonal structure. The stability of benzene molecule is due to the **extensive delocalization** of electron cloud. The **resonance energy** of benzene is **150.5 kJ/mol.** Greater the resonance energy greater the stability of the compound. It means benzene shows the phenomenon of resonance which makes it more stable than others. It has five resonance contributing structures. That's why delocalized electrons of benzene ring are not attacked by weak electrophiles and hence benzene is a stable molecule.

18. Write down the general mechanism of electrophilic substitution reactions of benzene.

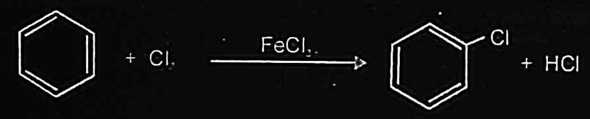
Ans. Mechanism of Electrophilic Substitution Reactions of Benzene

The general pattern of the chemical reactivity of benzene towards electrophiles can be shown as follows:



19. Write mechanism for the halogenation of benzene in the presence of catalyst.

Ans. Mechanism for halogenation of benzene in presence of catalyst

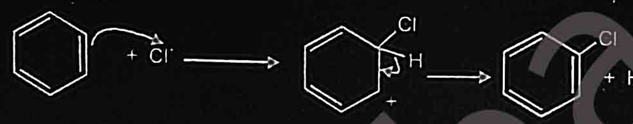


The catalyst used in halogenation of benzene is FeX_3.

(i) Generation of electrophile:

$$Cl_2 + FeCl_3 \longrightarrow Cl^+ + FeCl_4^-$$

(ii) Formation of benzenonium ion:



(iii) Regeneration of catalyst:

$$FeCl_4^- + H^+ \longrightarrow HCl + FeCl_3$$

20. How nitration of benzene takes place? Give its reaction.

Ans. Nitration of benzene

"The introduction of NO_2 group in benzene ring is called "Nitration".

The nitration of benzene takes place when it is heated with a 1:1 mixture of conc. HNO_3 and conc. H_2SO_4 at 50- 55°C.

Nitrating Agent:

Sulphuric acid reacts with nitric acid to generate nitronium ion (NO_2^+) which acts as nitrating agent.

Example:

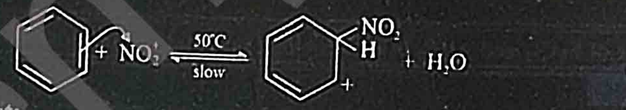


Mechanism:

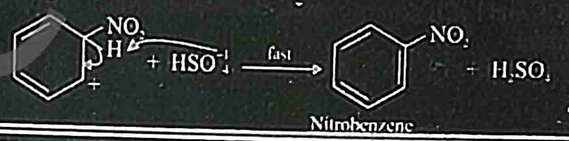
(i) Generation of electrophile:

$$HONO_2 + H_2SO_4 \xrightleftharpoons{50°C - 55°C} NO_2^+ + HSO_4^- + H_2O$$

(ii) Formation of benzenonium ion:



(iii) Regeneration of catalyst:



21. Define sulphonation of benzene with examples.

Ans. Sulphonation of benzene

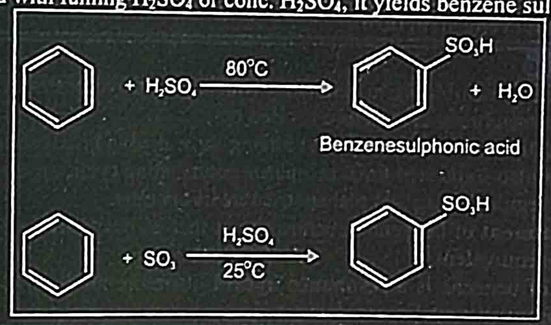
"The introduction of sulphonic acid group in benzene ring is called sulphonation".

Electrophile:

The electrophile used in this reaction is SO_3.

Examples:

When benzene is heated with fuming H_2SO_4 or conc. H_2SO_4, it yields benzene sulphonic acid.

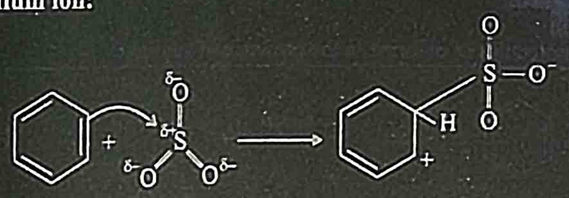


Mechanism:

(i) Generation of electrophile:

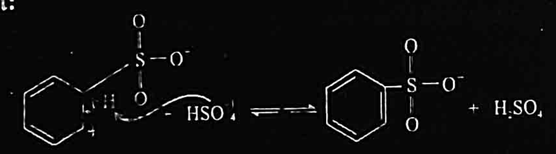
$$H_2SO_4 + H_2SO_4 \rightleftharpoons H_3O^+ + SO_3 + HSO_4^-$$

(ii) Formation of benzenonium ion:

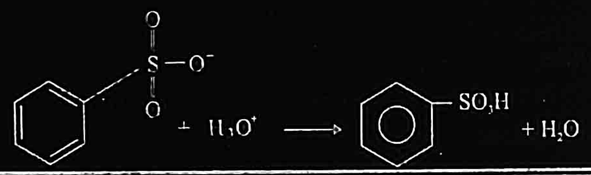


bhattiAcademy

(iii) Regeneration of catalyst:



(iv) Protonation:



22. What is the role of $FeCl_3$ and $AlCl_3$ in electrophilic substitution reactions of benzene?

Ans. Role of $FeCl_3$ and $AlCl_3$

Due to extensive delocalization of pi electrons, benzene is a very stable molecule. It is not attacked by weak electrophiles. The catalysts $AlCl_3$ and $FeCl_3$ generate strong electrophiles which can penetrate and break the continuous sheath of electron cloud in benzene.

$$R-Cl + AlCl_3 \longrightarrow AlCl_4^- + R^+$$

Carbocation



Alkyl benzene

23. Why benzene is given a cyclic structure?

Ans. Cyclic Structure of benzene

(i) Benzene does not show resemblance in behaviour with aliphatic hydrocarbons (alkanes, alkenes and alkynes). So, its straight chain structure is ruled out.

(ii) **Kekule** proposed cyclic structure for benzene having three double bonds alternating with three single bonds. **Dewar** also suggested three resonance contributing cyclic structures for benzene.

(iii) **X-ray** studies show regular hexagonal planar structure of benzene.

(iv) **Atomic orbital treatment** of benzene structure shows that π-electrons are delocalized and all six carbon atoms are equivalent.

(v) Since the structure of benzene is a **resonance hybrid**, therefore all the C-C bond lengths are equal. So, benzene is given a cyclic structure.



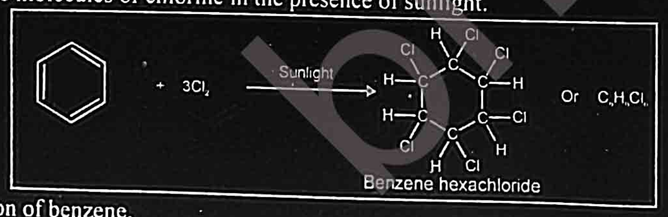
Benzene

24. What happens when chlorine is passed through benzene in the presence of
(a) Sunlight (b) $FeCl_3$

Ans. Reactions of Benzene with Cl_2

(a) In the presence of sunlight

Benzene adds three molecules of chlorine in the presence of sunlight.

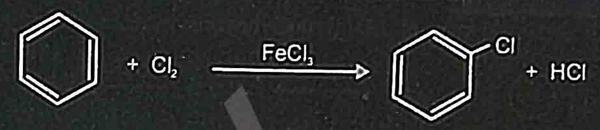


Benzene hexachloride

- It is an addition reaction of benzene.

(b) In the presence of $FeCl_3$

Benzene reacts with Cl_2 in the presence of $FeCl_3$ to form chlorobenzene.



- It is an electrophilic substitution reaction of benzene.

25. Prove with two chemical reactions that benzene behaves as a saturated hydrocarbon.

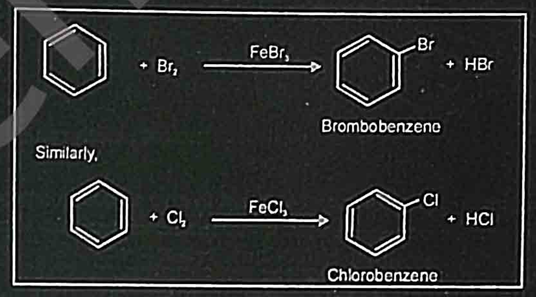
Ans. Benzene as Saturated Hydrocarbon

A saturated hydrocarbon gives substitution reactions rather than addition reactions.

(i) Halogenation of Benzene

"The introduction of halogen group in benzene ring is called halogenation."

Examples:



Brombobenzene

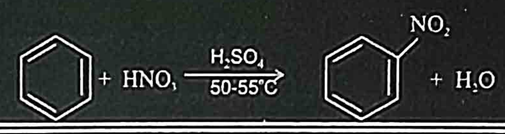
Similarly,

Chlorobenzene

(ii) Nitration of Benzene

"The introduction of NO_2 group in benzene ring is called nitration."

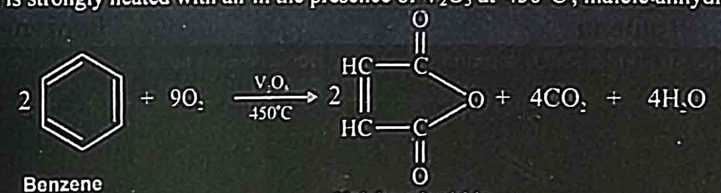
Example:



26. Prepare Maleic acid from benzene with the help of chemical reaction.

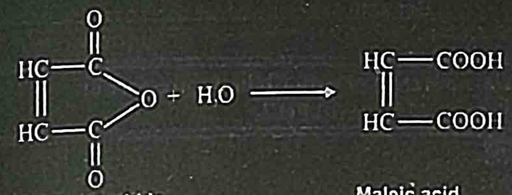
Ans. Preparation of Maleic Acid from Benzene

When benzene is strongly heated with air in the presence of V_2O_5 at 450°C, maleic-anhydride is formed.



Benzene Maleic anhydride

Maleic anhydride upon hydrolysis yields maleic acid.



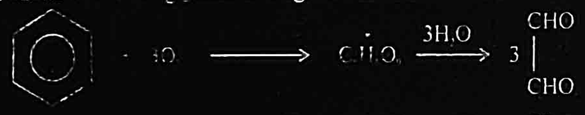
Maleic anhydride Maleic acid

bhattiAcademy

27. How Glyoxal is obtained from benzene?

Ans. Preparation of Glyoxal from Benzene

Benezene reacts with ozone and gives glyoxal through benzene triozonide.



Benzene triozonide Glyoxal

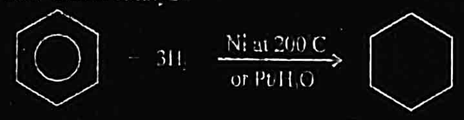
28. Detail out three reactions in which benzene behaves as if it is unsaturated.

Ans. Benzene as unsaturated Hydrocarbon

An unsaturated hydrocarbon gives addition reactions rather than substitution reactions.

(a) Reduction

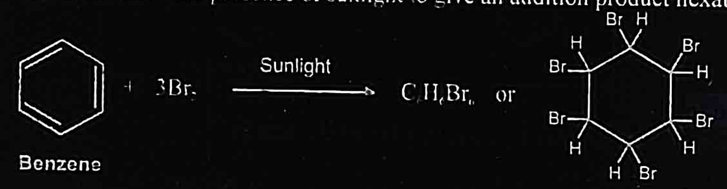
Benzene is reduced to cyclohexane on heating at high temperature with hydrogen in the presence of Pt in an acidic solvent (acetic acid) or Ni at 200°C as a catalyst



Cyclohexane

(b) Halogenation

Benzene reacts with bromine in the presence of sunlight to give an addition product hexabromo benzene.



Benzene

1, 2, 3, 4, 5, 6 - Hexabromocyclohexane

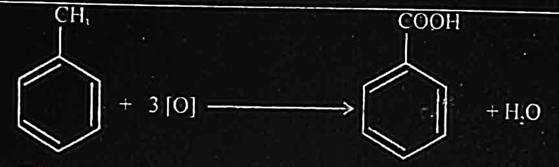
(c) Combustion

When benzene is burnt in free supply of air, it is completely oxidized to CO_2 and H_2O.

$$2C_6H_6 + 15O_2 \longrightarrow 12CO_2 + 6H_2O$$

29. Distinguish between benzene and toluene.

Ans.

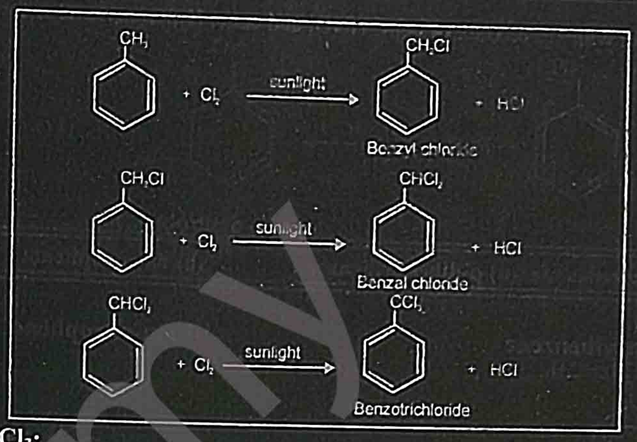
Toluene	Benzene
Toluene discharges the alkaline $KMnO_4$ solution.	Benzene does not decolourize the pink solution of alkaline $KMnO_4$.
 Toluene Benzoic acid	

30. What happens when toluene is treated with Cl_2 in the presence of:
(i) Sunlight (b) $FeCl_3$

Ans. Reaction of Toluene with Cl_2

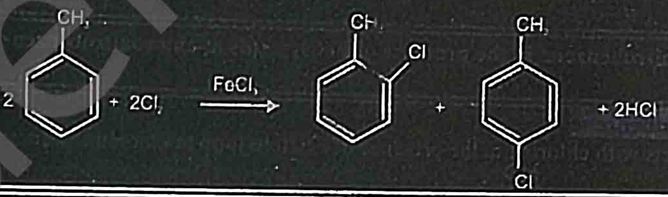
(i) In the presence of sunlight:

When toluene is treated with chlorine in the presence of sunlight only the methyl group is substituted.



(ii) In the presence of $FeCl_3$:

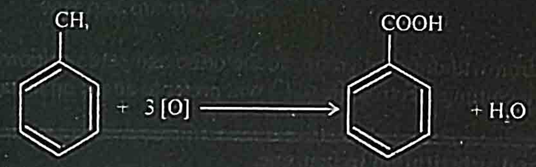
When toluene is treated with Cl_2 in the presence of $FeCl_3$, ortho and para-chlorotoluene are formed.



31. What happens when alkyl benzenes are treated with strong oxidizing agent (Acidic $KMnO_4$)?

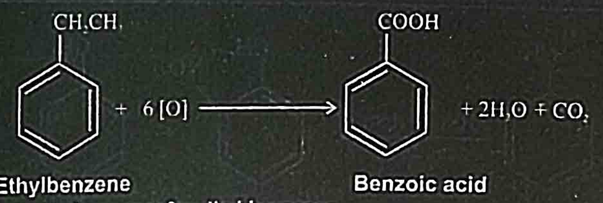
Ans. Reactions of Alkyl Benzenes with Acidic $KMnO_4$

Alkyl benzenes are readily oxidized by acidified $KMnO_4$. In these reactions, alkyl groups are oxidized keeping the benzene ring intact.



Toluene Benzoic acid

Whatever the length of an alkyl group may be it gives only one carboxyl group. Moreover, the colour of $KMnO_4$ is discharged.



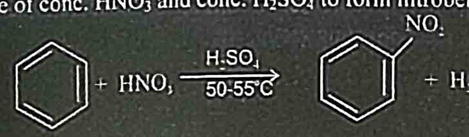
Ethylbenzene Benzoic acid

Therefore, this reaction is used as a test for alkyl benzenes.

32. How will you prepare m-dinitro benzene from benzene in two steps?

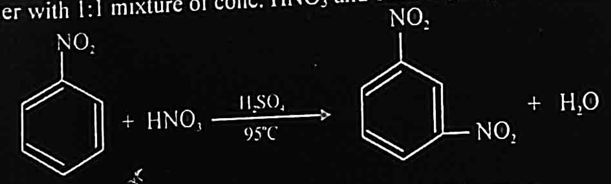
Ans. Preparation of m-dinitrobenzene from Benzene

(i) Benzene reacts with 1:1 mixture of conc. HNO_3 and conc. H_2SO_4 to form nitrobenzene at 50 – 55°C.



Bharat Academy

(ii) Nitrobenzene reacts further with 1:1 mixture of conc. HNO_3 and conc. H_2SO_4 at 95°C to form m-dinitrobenzene.

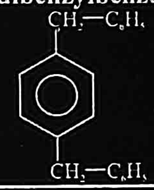


m - dinitrobenzene

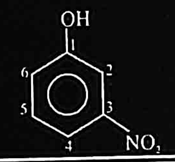
33. Draw structural formulas of: (a) p-dibenzylbenzene (b) m-nitrophenol

Ans. Structural formulas of

(a) p-dibenzylbenzene



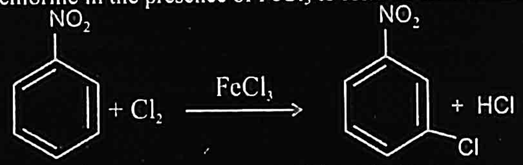
(b) m-nitrophenol



34. Chlorination of nitrobenzene in the presence of $FeCl_3$ yields m-chloronitrobenzene as the main product. Why?

Ans. Chlorination of Nitrobenzene

Nitrobenzene reacts with chlorine in the presence of $FeCl_3$ to form m-chloronitrobenzene.



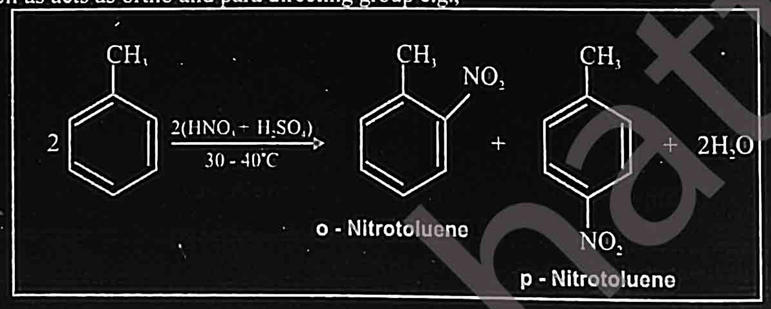
m-Chloronitro benzene

Since, NO_2 group is electron withdrawing group, so the ortho and para positions become more electron deficient than the meta position. Thus, the incoming electrophile (Cl^+) will prefer to attack on meta position. In this way, we get m-chloronitrobenzene.

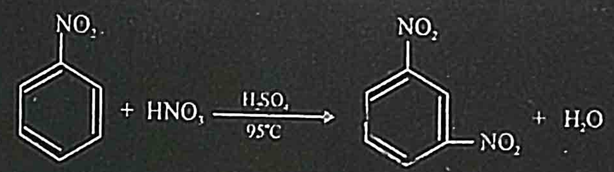
35. Write two rules for second substitution in benzene.

Ans. Rules for Second Substation in Benzene

(i) If electron donating group is present on benzene as substituent then it will increase the reactivity of ring as well as acts as ortho and para directing group e.g.,



(ii) If electron withdrawing group is present on benzene as substituent then it will decrease the reactivity of ring as well as acts as meta directing group. e.g,



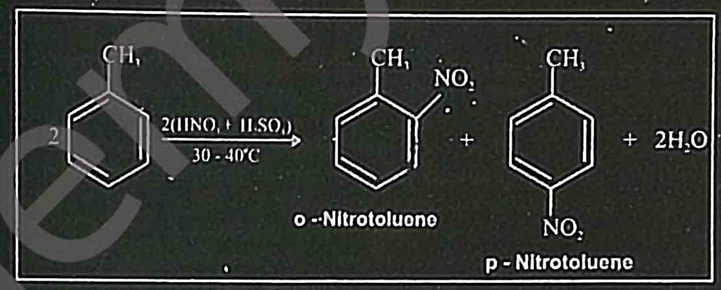
m - dinitrobenzene

36. Ortho and para directing groups increase reactivity of benzene. Why?

Ans. Reactivity of Benzene due to ortho and para directing groups

These groups release electrons to the benzene ring, there by facilitating the availability of electrons at ortho and para positions. This results in the increased chemical reactivity of benzene ring towards electrophiles. Hence, the rate of reaction increases.

Example:



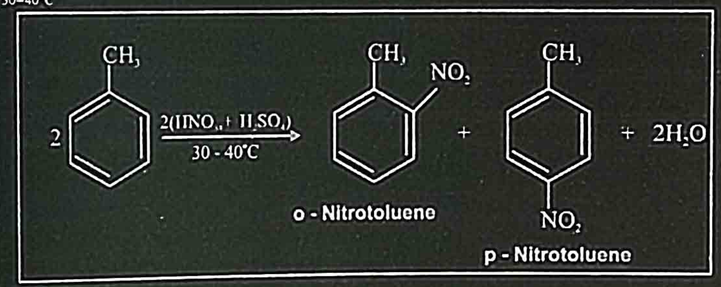
37. Complete the reactions:

(i) Toluene + $HNO_3 \xrightarrow[30-40°C]{H_2SO_4}$

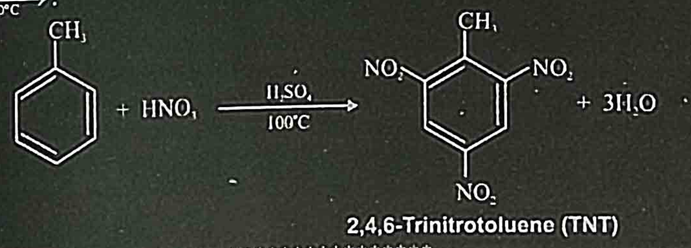
(ii) Toluene + $HNO_3 \xrightarrow[100°C]{H_2SO_4}$

Ans.

(i) Toluene + $HNO_3 \xrightarrow[30-40°C]{H_2SO_4}$:



(ii) Toluene + $HNO_3 \xrightarrow[100°C]{H_2SO_4}$:



2,4,6-Trinitrotoluene (TNT)

****

bhattiacademy

CHAPTER 10

ALKYL HALIDES

Solved Objective Exercise

Q1. Fill in the blanks.

(i). In tertiary alkyl halides the halogen atom is attached to a carbon which is further attached to ____ carbon atoms directly.
(ii). The best method for the preparation of alkyl halides is the reaction of____ with inorganic reagents.
(iii). An alkyl group with a partial positive charge on the carbon atom is called _____center.
(iv). The mechanism is called _____if it involves one molecule in the rate-determining step.
(v). The molecularity of a reaction is defined as the number of molecules taking part in the _____
(vi). The molecularity of E2 reaction is always two and the reaction show _____order kinetics.
(vii). Wurtz synthesis is useful for the preparation of____ alkanes.
(viii). Grignard reagents are prepared by the reaction of magnesium metal with alkyl halides in the presence of_____

Answers Key.

(i)	Three	(ii)	Alcohols
(iii)	Electrophilic	(iv)	Unimolecular
(v)	Rate determining step	(vi)	Second
(vii)	Symmetrical	(viii)	Dry ether

Q2. Indicate true or false.

(i). In secondary alkyl halides, the halogen atom is attached to a carbon which is further attached to two carbon atoms directly.
(ii). Alcohols react with thionyl chloride in ether as solvent to give alky halides.
(iii). Order of reactivity of alkyl halides for a particular alkyl group is
Iodide > Bromide > Chloride > Fluoride
(iv). In S_N2 reactions the attacking nucleophile always attacks from the side in which the leaving group is attached.
(v). Methyl magnesium iodide on hydrolysis yields ethyl alcohol.
(vi). Primary, secondary and tertiary amines react with Grignard reagents in the same way.
(vii). The reactions of secondary alkyl halides may follow both S_N1 and S_N2 mechanisms.
(viii). S_N1 mechanism is a one stage process involving a simultaneous bond breakage and bond formation.
(ix). In β-elimination reactions, the two atoms or groups attached to two adjacent carbon atoms are lost under the influence of an electrophile.
(x). The reactivity order of alkyl halides is determined by the strength of carbon-halogen bond.

Answers Key.

(i)	True	(ii)	False	(iii)	True	(iv)	False	(v)	False
(vi)	True	(vii)	True	(viii)	False	(ix)	False	(x)	True

bhattiAcademy

Q3. Multiple Choice Questions. Encircle the correct answer.

(i). In primary alkyl halides, the halogen atom is attached to a carbon which is further attached to how many carbon atoms
(a) Two (b) Three (c) One (d) four

(ii). The reactivity order of alkyl halides for a particular alkyl group is
(a) Fluoride > Chloride > Bromide > Iodide
(b) Chloride > Bromide > Fluoride > Iodide
(c) Iodide > Bromide > Chloride > Fluoride
(d) Bromide > Iodide > Chloride > Fluoride

(iii). When CO_2 is made to react with ethyl magnesium iodide, followed by acid hydrolysis, the product formed is
(a) Propane (b) Propanoic acid (c) Propanal (d) Propanol

(iv). Grignard reagent is reactive due to
(a) the presence of halogen atom (b) the presence of Mg atom
(c) the polarity of C—Mg bond (d) none of above

(v). S_N2 reactions can be best carried out with
(a) Primary alkyl halides (b) Secondary alkyl halides
(c) Tertiary alkyl halides (d) All the three

(vi). Elimination bimolecular reactions involve
(a) first order kinetics (b) second order kinetics
(c) third order kinetics (d) zero order kinetics

(vii). For which mechanisms, the first step involved is the same
(a) E1and E2 (b) E2 and S_N2 (c) S_N1 and E2 (d) E1 and S_N1

(viii). Alkyl halides are considered to be very reactive compounds towards nucleophiles, because
(a) they have an electrophilic carbon
(b) they have an electrophilic carbon and a good leaving group.
(c) they have an electrophilic carbon and a bad leaving group.
(d) they have a nucleophilic carbon and good leaving group.

(ix). The rate of E1 reaction depends upon
(a) the concentration of substrate
(b) the concentration of nucleophile
(c) the concentration of substrate as well as nucleophile
(d) None of the above

(x). Which one of the following is not a nucleophile
(a) H_2O (b) H_2S (c) BF_3 (d) NH_3

Solved Exercise MCQ's

Q.No.	Answer	Reason
(i).	(c) One	$H_3C - CH_2 - Cl$
(ii).	(c) Iodide > Bromide > Chloride > Flouride	Reactivity $\propto \frac{1}{\text{Bond Energy}}$ as C – F has highest bond energy while C – I has lowest bond energy among them. So, this reactivity order is correct.
(iii).	(b) Propanoic acid	$CH_3-CH_2-Mg-Br + O=C=O \xrightarrow{Ether} O=C(-CH_2CH_3)-OMgBr \xrightarrow{H_3O^+} O=C(-CH_2CH_3)-OH + Mg(Br)(OH)$ (Ethylmagnesium bromide; Carbon dioxide; Propanoic acid)
(iv).	(c) Due to Polarity of C – Mg bond	$^{\delta-}C - Mg^{\delta+}$ bond is very polar due to high electronegativity difference (1.3)
(v).	(a) Primary alkylhalide	Because stearic hindrance in Primary alkylhalide is less and primary carbocation is unstable.

(vi).	(b) Second order kinetics	Rate $= k[\text{Alkylhalide}]^1[\text{base}]^1$ $n = 1 + 1 = 2^{nd}$ order
(vii).	(d) E_1 and S_N1	In both mechanisms, first step is ionization of tertiary alkyl halide.
(viii).	(b) They have electrophilic carbon and good leaving group	$Nu^- + -C-L \longrightarrow Nu-C- + L^-$
(ix).	(a) Concentration of substrate	First step is rate determing step in which reactant is substrate.
(x).	(c) BF_3	BF_3 has no electron pair or negative charge on central atom 'B'. So it attracts electrons and acts as electrophile.

Previous Boards MCQ's

1. Which of the following is not a nucleophile (D.G Khan 2008 Lhr 2012)
(a) H_2O (b) H_2S (c) BF_3 (d) NH_3

2. H_3O^+ has one lone pair of electrons on oxygen. It cannot act as (D.G Khan 2009)
(a) Lewis acid (b) Nucleophile (c) Strong acid (d) Electrophile

3. When $CH_3 - CH_2OH$ is made to react with Grignard's reagent the product formed is (D.G Khan 2010)
(a) Alkane (b) Ether (c) Alcohol (d) Alkene

4. Elimination bimolecular reactions involve kinetics (Rwp 2008)
(a) 1st order (b) 2nd order (c) 3rd order (d) Zero order

5. In S_N2 mechanism, the hybridization of carbon atom changes from sp^2 to (Rwp 2009)
(a) sp^2 (b) sp (c) dsp^2 (d) sp^3

6. For which mechanism, the first step involved is the same (Fsd 2008)
(a) E1 and E2 (b) E2 and S_N2 (c) S_N1 and E2 (d) E1 and S_N1

7. The order of a typical S_N2 reaction is (Fsd 2010)
(a) Zero (b) First (c) Second (d) Third

8. S_N2 reactions can be best carried out with (Fsd Sup 2010)
(a) Primary alkyl halides (b) Secondary alkyl halides
(c) Tertiary alkyl halides (d) Alkyl halides

9. Reaction of CO_2 with ethyl magnesium bromide, followed by acid hydrolysis produce (Sgr 2010)
(a) Propane (b) Propanoic acid (c) Prpanal (d) Propanol

10. Primary alcohol is obtained by treating Grignard Reagent with (Grw 2010)
(a) HCHO (b) CH_3CHO (c) CH_3COCH_3 (d) CO_2

11. S_N1 reactions are easily given by (Grw 2011)
(a) Primary alkyl halide (b) Secondary alkyl halide
(c) Secondary alcohols (d) Primary alcohols

12. The common name of 2-Methyl–2–chloropropane is (Lhr 2008)
(a) Iso butyl chloride (b) Secondary butyl chloride
(c) Tertiary butyl chloride (d) n-butyl chloride

13. In primary alkyl halides the halogen atom attached to a carbon atom which is further attached to how many carbon atoms (Lhr 2009)
(a) Two (b) Three (c) One (d) Four

14. Ethyl magnesium bromide reacts with water to form (Lhr 2010)
(a) Ethane (b) Methane (c) Propane (d) n-butane

15. Reaction of following with Grignard's reagent can give primary alcohol (Lhr 2011)
(a) Epoxide (b) Peroxide (c) Super oxide (d) Hydrogen oxide

Bhatti Academy

Entry Test MCQ's

1. Alkyl halides are used for the preparation of
(a) Alkanes (b) Alcohols (c) Alkenes (d) All of these
2. Which one of the following is an explosive
(a) Nitrobenzene (b) Nitromethane (c) Picric acid (d) Trinitrobenzene
3. The compound which are not found naturally
(a) Alkanes (b) Fats (c) Carbohydrates (d) Alkyl halides
4. A Grignard reagent is prepared by the action of magnesium in dry ether on
(a) C_2H_5OH (b) C_2H_5SNa (c) C_2H_5Cl (d) All of the these
5. Ethyl alcohol is obtained when ethyl chloride is boiled with
(a) Water (b) Alcoholic KOH (c) Aqueous KOH (d) H_2SO_4
6. Decreasing order of reactivity of alkyl halide is
(a) RI > RCl > RBr (b) RI > RBr > RCl (c) RBr > RCl > RI (d) RCl > RBr > RI
7. Which reagent cannot be used to prepare an alkyl halide from an alcohol
(a) NaCl (b) PCl_5 (c) $SOCl_2$ (d) $ZnCl_2$+HCl
8. Ethyl bromide reacts with lead-sodium alloy to form
(a) Tetraethyl lead (b) Tetraethyl lead bormide (c) Ethylsodiumbromide (d) Do not react
9. How many structural isomers are possible for $C_2H_4Br_2$
(a) 1 (b) 2 (c) 3 (d) 4
10. Which one of the following will produce a primary alcohol by reacting with CH_3MgI
(a) Acetone (b) Ethylene oxide (c) Methyl cyanide (d) Ethyl acetate
11. S_N1 reaction is favoured by
(a) Non-polar solvents
(b) Small groups on the carbon atom attached to halogen atom
(c) Bulky groups on the carbon atom attached to halogen atom
(d) None of the above
12. Tertiary alkyl halides are practically inert to substitution by S_N2 mechanism because of
(a) Insolubility (b) Inductive effect (c) Instability (d) Stearic hindrance
13. Which of the following is liquid at room temperature
(a) CH_3I (b) C_2H_5Cl (c) CH_3Br (d) CH_3F
14. Which of the following is a primary alkyl halide
(a) Isopropyl iodide (b) Secondary butyl iodide
(c) Tertiary butyl bromide (d) Neo hexyl chloride
15. Wurtz reaction involves the interaction of alkyl halides in dry ether with
(a) Sodium (b) Copper (c) Zinc (d) Platinum
16. Which of the following is an insecticide?
(a) DDT (b) CHI_3 (c) $CHCl_3$ (d) $CF_3 - CF_3$
17. Reactivity of alkyl halides depends upon
(a) C–X bond energy (b) C–X bond polarity
(c) C–X bond strength (d) None of the above
18. Which of the following is the best method to prepare alkyl halide from alcohol with
(a) HX in the presence of $ZnCl_2$ catalyst (b) $SOCl_2$ in the presence of pyridine solvent
(c) PCl_3 or PCl_5 (d) Difficult to differentiate
19. Which of the following nucleophile is good leaving group
(a) OH^- (b) NH_2 (c) OR (d) Br
20. Which of the following type of ether is used as solvent in Grignard reagent preparation
(a) Dimethyl ether (b) Ethyl methyl ether (c) Diethyl ether (d) All of the above
21. The reaction $C_2H_5Br+KCN \longrightarrow C_2H_5CN+KBr$ is an example of
(a) Elimination (b) Nucleophilic substitution (c) Electrophilic substitution (d) Redox change
22. The reaction of ethyl alcohol and methyl magnesium bromide gives
(a) CH_4 (b) C_2H_6 (c) C_3H_8 (d) C_4H_{10}

Additional MCQ's

1. The reaction in which the halogen is replaced by some other atom or group of atoms is called
(a) S_N reaction (b) Elimination reaction (c) Oxidation (d) Reduction
2. The alkylhalide molecule on which a nucleophile attacks is called
(a) Substrate Molecule (b) Leaving Molecule (c) Electron rich (d) Alkane Molecule
3. The shortest bond length is of _____
(a) C-F (b) C-H (c) C-I (d) C-Br
4. The alkylfluorides do not react under ordinary condition because C-F bond is
(a) Weak bond (b) Strong bond (c) High bond Polarity (d) Least Bond energy
5. The carbon atom of an alkyl group attached with halogen atom bears a charge
(a) Partial Positive (b) Positive (c) Partial Negative (d) Negative
6. $C_2H_5O^-$ is
(a) Hydroxide ion (b) Cyanide ion (c) Ethoxide ion (d) None of these
7. Phosphorous trihalide or phosphorous pentahalide reacts with alcohols to replace
(a) H Group (b) Chloride Group (c) OH Group (d) Bromide Group
8. The general formula of alkyl halides is
(a) $C_nH_{2n+1}X$ (b) C_nH_{2n-1} (c) C_nH_{2n} (d) $C_{2n}H_n$
9. The best method for the preparation of alkyl halides is the reaction of _____ with inorganic reagents
(a) Alcohols (b) Organic compounds (c) Halides (d) None of these
10. _____ main factors which govern the reactivity of R-X bond.
(a) Two (b) Three (c) Four (d) All of above
11. Vicinal dihalides on treatment with zinc dust gives
(a) Alkane (b) Alkyne (c) Alkene (d) Alkyl halide
12. Which is not a nucleophile
(a) $AlCl_3$ (b) H_2S (c) H_2O (d) NH_3
13. The reactions which involves the removal of HX from the halide are called
(a) Elimination or E reactions (b) Oxidation reaction
(c) S_N reaction (d) Reduction reaction
14. The group which attacks the substrate in S_N reaction is called
(a) Electrophile (b) Nucleophile (c) Radical group (d) Neutral group
15. Nucleophile is usually
(a) Basic in character (b) Acidic in character
(c) Basic and positively charged (d) Basic and negatively charged
16. Poor leaving group is
(a) Cl^- (b) Br^- (c) HSO_4^- (d) NH_2^-
17. Good leaving group is
(a) I^- (b) NH_2^- (c) OH^- (d) OR^-
18. In S_N2 reaction the direction of attack of nucleophile is
(a) In front of leaving group (b) Opposite side of leaving group
(c) Directly to leaving group (d) All of them
19. Reduction of alkyl halide in the presence of aqueous acid and Zn forms corresponding
(a) Alkane (b) Alkene (c) Alkyne (d) None of them
20. _____ is used as an anti-knocking agent
(a) Tetra methyl lead (b) Tetra ethyl lead (c) Tetra propyl lead (d) Both a and b
21. When a Grignard reagent reacts with carbonyl compound it forms
(a) Formaldehyde (b) Aldehydes (c) Alcohols (d) Carboxylic acids

KrattiAcademy

22. Whenever RMgX reacts with propanone it forms
(a) Pri-alcohol (b) Ter-alcohol (c) Sec-alcohol (d) Alkane

23. Ethoxide Ion $C_2H_5O^-$ is an example of
(a) Lewis acid (b) Lewis Base (c) Electrophile (d) Both a and c

24. OH^- ion is a leaving group
(a) Good leaving group (b) Moderate leaving group
(c) Both a and b (d) Poor leaving group

25. When halogen atom is removed _____ is produced
(a) Hydrogen ion (b) Ammonium ion (c) Carbocation (d) None of above

26. In Wurtz synthesis alkyl halide react with sodium in _____ to give alkanes
(a) Alcohol (b) Ether (c) Water (d) Zn/HCl

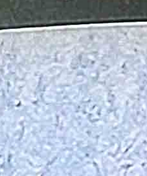
ANSWERS TO MCQ'S

Previous Board MCQ's

Q.No.	Answer	Reason
1.	(c) BF_3	There is no electron pair or negative charge on central atom B so it is not a nucleophile.
2.	(b) Nucleophile	H_3O^+ is a positive radical and acts as electrophile.
3.	(a) Alkane	Grignard reagent + (H–OH, R–OH, $H–NH_2$) ⟶ Alkanes
4.	(b) 2nd order	$Rate = k[Alkylhalide]^1[Base]^1$ $n = 1 + 1 = 2^{nd}$ order reaction
5.	(d) sp^3	$OH^- + H–C(H)_2–Br \longrightarrow HO\cdots C(H)_2\cdots Br^- \longrightarrow HO–CH_2–H + Br^-$ Transition state; Inverted molecule; Leaving group
6.	(d) E1 and S_N1	First step is ionization in both.
7.	(c) Second	$Rate = k[Alkylhalide]^1[Base]^1$ $n = 1+1 = 2^{nd}$ order
8.	(a) Primary alkyl halide	Because stearic hindrance in Primary alkylhalide is less and primary carbocation is unstable.
9.	(b) Propanoic acid	$CH_3–CH_2–Mg–Br + O=C=O \xrightarrow{Ether} O=C(CH_2CH_3)–OMgBr \xrightarrow{H_3O^+} O=C(CH_2CH_3)–OH + Mg(Br)(OH)$ Ethylmagnesium bromide; Carbon dioxide; Propanoic acid
10.	(a) HCHO	$CH_3–CH_2–Mg–Br + HCHO \xrightarrow{Ether} H–C(H)(CH_2CH_3)–OMgBr \xrightarrow{H_3O^+} H–C(H)(CH_2CH_3)–OH + Mg(Br)(OH)$ Ethylmagnesium bromide; Methanal; 1-Propanol (Primary alcohol)
11.	(b) Secondary alkyl halide	Secondary alkyl halide completes reaction in two steps and give S_N1 reaction.
12.	(c) Tertiary Butylalcohol	$CH_3–C(Cl)(CH_3)–CH_3$
13.	(c) One	Ethyl chloride and propyl chloride are primary alkyl halides.

14.	(a) Ethane	$CH_3–CH_2–Mg–Br + H–O–H \xrightarrow{Ether} CH_3–CH_3 + Mg(Br)(OH)$ Ethylmagnesium bromide; Water; Ethane
15.	(a) Epoxide	$CH_3–CH_2–Mg–Br + CH_2–CH_2 \xrightarrow{Ether} CH_3–CH_2–CH_2–CH_2OMgBr \xrightarrow{H_3O^+} CH_3–CH_2–CH_2–CH_2–OH + Mg(Br)(OH)$ Ethylene epoxide; 1-Butanol (Primary alcohol)

Entry Test MCQ's

Q.No.	Answer	Reason
1.	(d) All of these	(i) $CH_3–CH_2–Cl + KOH \xrightarrow{alcohlic} CH_2=CH_2 + KCl + H_2O$ $R–Cl + Mg \xrightarrow{Ether} R–\overset{\delta-}{M}g–\overset{\delta-}{Cl}$ (ii) $CH_3–\overset{\delta-}{C}H_2–\overset{\delta+}{M}g–Br + H–OH \longrightarrow CH_3–CH_3 + Mg$ Ethane (iii) $CH_3–CH_2–Mg–Br + HCHO \longrightarrow CH_3–CH_2–CH_2–OMgBr \xrightarrow{H_3O^+}$ $CH_3–CH_2–CH_2–OH + MgBrOH$ (1 - Propanol)
2.	(c) Picric acid	
3.	(d) Alkylhalide	Alkylhalide are not naturally occurring compounds. They are synthetic compounds and oily in nature.
4.	(c) C_2H_5Cl	$C_2H_5Cl + Mg \xrightarrow{dry\ ethers} CH_3–CH_2–Mg–Cl$ (Ethyl magnesium chloride)
5.	(c) Aqueous KOH	$CH_3–CH_2–Cl + KOH \xrightarrow{aqueous} CH_3–CH_2–OH + KCl$
6.	(b) RI > RBr > RCl	Reactivity $\propto \frac{1}{\text{Bond energy}}$ R-I has least bond energy $(208\,kJmol^{-1})$ and R-Cl has maximum bond energy $(346\,kJ\,mol^{-1})$
7.	(a) NaCl	$CH_3–OH + NaCl \longrightarrow$ No reaction
8.	(b) Tetraethyl lead	$4C_2H_5Br + Na_4Pb \longrightarrow (C_2H_5)_4Pb + 4NaBr$ Tetraetyl lead
9.	(b) 2	(i) $CH_2(Br)–CH_2(Br)$ (ii) $CH_3–CH(Br)_2$
10.	(b) Ethylene oxide	$CH_2–CH_2$ (O)
11.	(c) Bulky group on carbon atom attached to halogen atom	Due to bulky group base cannot easily attack on it so in first step it converts in carbocation so OH^- can easily attack on it in second step.

bhatti Academy

12.	(d) Stearic hindrance	Due to bulky group base cannot easily attack on it so in first step it converts in carbocation so OH^- can easily attack on it in second step.
13.	(a) CH_3I	Due to large size of iodine polarizability effect is high and intermolecular forces are strong.
14.	(d) Neo hexylchloride	Cl is attached that carbon which is directly attached with one C.
15.	(a) Sodium	$2CH_3-Cl+2Na \xrightarrow{ether} CH_3-CH_3+2NaCl$
16.	(a) DDT	Dichlorodiphenyltrichloroethane
17.	(c) C – X bond strength	$\text{Reactivity} \propto \frac{1}{\text{bond strength}}$ Greater bond strength lesser will be reactivity and vice versa.
18.	(b) $SOCl_2$ in presence of pyridine solvent	$CH_3-CH_2-OH+SOCl_2 \xrightarrow{Pyridine} CH_3-CH_2-Cl+HCl+SO_2$ It is best method because SO_2 and HCl gases can easily remove.
19.	(d) Br^-	It leaves from alkylhalide easily and bears negative charge so it is good leaving group and nucleophile.
20.	(c) Diethyl ether	Both dimethyl ether and ethylmethyl ether are gases while diethylether is liquid at room temperature.
21.	(b) Nucleophilic substitution	In this reaction CN^- (nucleophile) replace the bromide ion (Br^-) so it is nucleophilic substitution.
22.	(a) CH_4	$CH_3-Mg-Br+CH_3-CH_2-OH \xrightarrow{Ether} CH_4+Mg(Br)(OC_2H_5)$

Additional MCQ's

Q.No.	Answer	Reason
1.	(a) S_N Reaction	$CH_3-Cl+OH^- \longrightarrow CH_3-OH+Cl^-$
2.	(a) Substrate molecule	$CH_3-Cl+OH^- \longrightarrow CH_3OH+Cl^-$ (Substrate molecule)
3.	(a) C – F	It is very strong and have short bond length due to small size of Flourine.
4.	(b) Strong bond	C – F bond is strong bond and have high bond energy (467 kJ mol^{-1})
5.	(a) Partial positive	$\overset{\delta+}{R}-C\overset{\delta-}{l}$, $CH_3-\overset{\delta+}{C}H_2-C\overset{\delta-}{l}$ Due to high electronegativity of X, C bears partial positive charge.
6.	(c) Ethoxide ion	$CH_3-CH_2-O^- \Rightarrow$ Two C-atoms and negative charge on oxygen.
7.	(c) – OH group	$3CH_3OH+PCl_3 \longrightarrow 3CH_3Cl+H_3PO_3$ $C_2H_5OH+PCl_5 \longrightarrow C_2H_5Cl+POCl_3+HCl$
8.	(a) $C_nH_{2n+1}X$	If n = 1 CH_3X (halomethane) n = 2 C_2H_5X (Haloethane)
9.	(a) Alcohols	$CH_3OH+HCl \xrightarrow[Heat]{ZnCl_2} CH_3Cl+H_2O$ $CH_3OH+SOCl_2 \xrightarrow{Pyridine} CH_3Cl+SO_2+HCl$
10.	(a) Two	(i) Bond energy (ii) Bond polarity
11.	(c) Alkene	$R-\underset{X}{CH}-\underset{X}{CH_2}+Zn \xrightarrow{CH_3OH} H_2C=CH-R+ZnX_2$ Alkene
12.	(a) $AlCl_3$	There are no electron pair and negative charge on central atom (Al) so it is

		not a nucleophile.
13.	(a) Elimination or Ere action	$CH_3-CH_2-Cl+KOH \xrightarrow{Alcoholic} CH_2=CH_2+H_2O+KCl$
14.	(b) Nucleophile	$OH^-+CH_3-Cl \longrightarrow CH_3OH+Cl^-$
15.	(d) Basic and negatively charged	NH_3, OH^-, Br^-, Cl^- etc. They can give electron so they are Lewis base.
16.	(d) NH_2^-	It cannot depart from its compound so it is poor leaving group.
17.	(a) I^-	It is good leaving group due to low bond energy (228 kJmol^{-1})
18.	(b) Opposite side of leaving group	Due to repulsion, it attacks from the side which is opposite to the leaving group.
19.	(a) Alkane	$CH_3-Cl+Zn+H^++Cl^- \longrightarrow CH_4+ZnCl_2$
20.	(d) both a and b	$(CH_3)_4$ Pb Tetramethyl lead $(C_2H_5)_4$ Pb Tetraethyl lead
21.	(a) Alcohol	HCHO + Grignard reagent ⟶ Primary Alcohol R–CHO + Grignard reagent ⟶ Secondary Alcohol RCOR + Grignard reagent ⟶ Tertiary Alcohol
22.	(b) Ter-Alcohol	$CH_3-CH_2-Mg-Br+(CH_3)_2C=O \xrightarrow{Ether} (CH_3)_2C(CH_2CH_3)OMgBr \xrightarrow{H_2O} (CH_3)_2C(CH_2CH_3)OH+Mg(Br)(OH)$ Ethylmagnesium bromide, Propanone, 2-Methyl-2-butanol (Tertiary alcohol)
23.	(b) Lewis base	$C_2H_5O^-$ has negative charge and can give electron pair so it is Lewis base.
24.	(d) Poor leaving group	It is strong nucleophile and cannot easily depart with unshared pair of electron.
25.	(c) Carbocation	$H_3C-X \longrightarrow H_3C^+ + X^-$
26.	(b) Ether	$2CH_3Cl+2Na \xrightarrow{Ether} CH_3-CH_3+2NaCl$

Short Answers Questions

1. What are primary, secondary and tertiary alkyl halides? Give one example in each case. (Mtn 12, Grw 09)

Ans. Primary Alkyl Halides

"Those alkyl halides in which halogen atom is attached with a carbon atom which is further attached with one or no carbon atom are called primary alkyl halides."

Examples:

CH_3-Cl Chloromethane; CH_3-CH_2-Cl Chloroethane; $CH_3-CH_2-CH_2-Cl$ 1-Choropropane

Secondary Alkyl Halides

"Those alkyl halides in which halogen atom is attached with a carbon atom which is further attached to two other carbon atoms directly are called secondary alkyl halides."

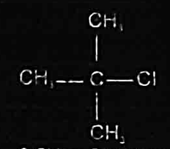
Examples:

$CH_3-\underset{CH_3}{\overset{}{CH}}-Cl$ 2 - Chloropropane; $CH_3-\underset{}{\overset{Cl}{CH}}-CH_2-CH_3$ 2 - Chlorobutane

Tertiary Alkyl Halides

"Those alkyl halides in which halogen atom is attached to a carbon atom which is further attached to three carbon atoms directly are called tertiary alkyl halides."

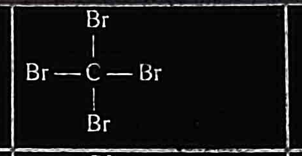
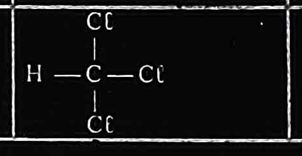
Example:



2-Chloro-2-methylpropane

2. Write IUPAC names of CBr_4 and $CHCl_3$. (LHR 09)

Ans.

Molecular Formula	Structural Formula	IUPAC Name	Common Name
CBr_4		Tetrabromomethane	Carbon tetrabromide
$CHCl_3$		Trichloromethane	Chloroform

3. Give two preparation methods of alkyl halides from alcohols. (LHR 09)

Ans. Preparation methods of alkyl halides from alcohols

(i) Reactions of alcohols with halogen acids

Alcohols may be converted to the corresponding alkyl halides by the action of halogen acid in the presence of $ZnCl_2$ which acts as a catalyst (Lucas reagent).

$$CH_3CH_2OH + HX \xrightarrow{ZnCl_2} \underset{\text{Ethyl halide}}{CH_3CH_2X} + H_2O$$

$$CH_3CH_2OH + HCl \xrightarrow{ZnCl_2} \underset{\text{Ethyl chloride}}{CH_3CH_2Cl} + H_2O$$

(ii) Reactions of alcohols with PBr_3 and PCl_5

Phosphorus trihalides or phosphorus pentahalides react with alcohols to replace -OH group by a halo group.

$$3CH_3-CH_2-OH + PBr_3 \longrightarrow 3CH_3-CH_2-Br + H_3PO_3$$

$$CH_3-CH_2-OH + PCl_5 \longrightarrow CH_3-CH_2-Cl + POCl_3 + HCl$$

4. How will you prepare alkyl halide when alcohol reacts with thionyl chloride in pyridine? Why this method is regarded as best method of preparation of alkyl halide? (Grw 10)

Ans. Preparation of Alkyl Halide by Reaction of Alcohol with SOCl₂

Alcohols react with thionyl chloride in pyridine as a solvent to give alkyl chlorides.

$$ROH + SOCl_2 \xrightarrow{Pyridine} R-Cl + SO_2 + HCl$$

$$\underset{\text{Ethyl chloride}}{CH_3CH_2Cl} + SO_2 + HCl$$

Best Method:

This method is especially useful since the by-products (HCl, SO_2) are gases, which escape leaving behind the pure product.

5. Name two factors which govern reactivity of R – X bond. Explain any one. (Fsd 10)

Ans. Reactivity of Alkyl Halides

There are two main factors which govern the reactivity of R – X bond. These are:

(i) C—X Bond energy **(ii)** C—X Bond polarity

Bond Energy:

Smaller the bond energy, greater will be the reactivity of a bond and vice versa. The strength of the bonds shows that iodo compounds (with the weakest bonds) would be the most reactive one while fluoro compounds will be the least reactive. So the order of reactivity of alkyl halides should be

Bond	Bond Energy (kJ/mole)
C—F	467
C—H	413
C—Cl	346
C—Br	290
C—I	228

$$R—I > R—Br > R—Cl > R—F$$

6. Why alkyl halides are more reactive than alkanes? (Grw 12)

Ans. Alkyl Halides are more reactive than Alkanes

The reactivity of a compound depends upon its

(i) Bond polarity: A polar bond is more reactive than a non-polar bond.

(ii) Bond energy: A bond having low energy is reactive than having high energy.

In alkyl halides, the C – X bond is polar and have low bond energy. As a result, alkyl halides are reactive compounds.

On the other hand, **in alkanes** the C – H and C – C bonds are non-polar and have high bond energy. That is why alkanes are less reactive compounds and are called paraffins.

7. Define the following with examples in each case: (a) Nucleophile (b) Leaving Group (Rwp 10)

Ans. (a) Nucleophile

- Nucleophile means nucleus loving.
- It has an unshared electron pair available for bonding.
- In most cases it is basic in character.
- It may be negatively charged or neutral.

Examples of Nucleophiles:

OH^-	Hydroxide ion	Cl^-	Chloride ion
$C_2H_5O^-$	Ethoxide ion	Br^-	Bromide ion
H_2S^-	Hydrogen sulphide ion	NH_3	Ammonia
SCN^-	Thiocyanate ion	CN^-	Cyanide ion
H_2O:	Water	I^-	Iodide ion
NH_2^-	Amino group		

(b) Leaving Group

- Leaving group (L) is also a nucleophile.
- It is called leaving group because it departs with an unshared pair of electrons.
- If we wish a S_N reaction to proceed in the forward direction the incoming nucleophile must be stronger than the departing one.

Examples:

Good Leaving Groups	Poor Leaving Groups	Good Leaving Group & Good nucleophile
Cl^-, Br^-, I^-, HSO_4^-	$\bar{O}H$, $\bar{O}R$, NH_2^-	I^- (Iodide ion)

8. Differentiate between electrophile and nucleophile.

Ans.

Nucleophile	Electrophile
1. Nucleophile means nucleus loving.	1. Electrophile means electron loving.
2. Negatively charged ions (anions) are nucleophiles e.g. Cl^-, H^-, Br^-, SO_4^{-2}, HSO_4^- etc.	2. Positively charged ions are electrophiles e.g. H^+, Cl^+, Br^+, NH_4^+, H_3C^+ etc.

PrattiAcademy

3. Neutral molecules in which central atom have lone pair of electrons e.g. PCl_3, PH_3, SO_2, NH_3 etc.	3. Neutral molecules having central atom which is deficient in electrons e.g. $BF_3, BeCl_2, AlCl_3, ZnCl_2$ etc.
4. Lewis bases are usually nucleophiles.	4. Lewis acids are usually electrophiles.
5. Molecules having π – electrons (localized or delocalized) act as nucleophiles. e.g. ethene, benzene etc.	5. Molecules in which central atom has partial positive charge (δ^+) act as electrophile. e.g. PCl_5, SO_3, CO_2 etc.

9. Give two examples of nucleophilic substitution reactions. (Grw 12)

Ans. Nucleophilic Substitution Reactions

(i) $C_2H_5Br + KOH_{(aq)} \longrightarrow C_2H_5OH + KBr$

(Ethyl bromide) (Ethanol)

(ii) $CH_3 - CH_2 - Br + CH_3COO^-Na^+ \longrightarrow CH_3COOC_2H_5 + NaBr$

(Ethyl bromide) (Ethyl acetate)

10. What is S_N2 reaction? Give one example. (Grw 08)

Ans. S_N2 Reaction

"The nucleophilic substitution reaction mechanism in which breaking of C – X bond and the formation of C – Nu bond occur simultaneously in one step is called S_N2 reaction."

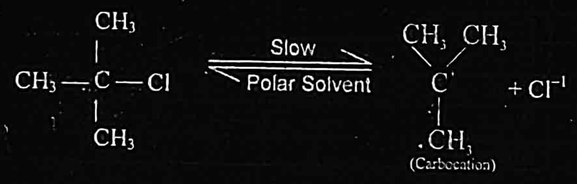
Example:

$C_2H_5Br + KOH_{(aq)} \longrightarrow C_2H_5OH + KBr$

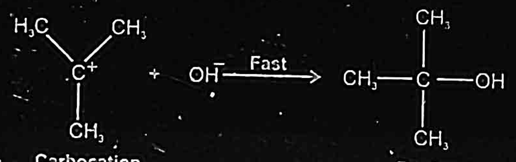
11. Explain mechanism of S_N1 reaction. (Rwp 10)

Ans. Mechanism of S_N1 Reaction

First Step:



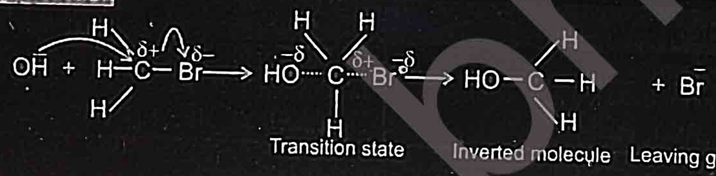
Second Step:



- The mechanism is called unimolecular (molecularity is one) because only one molecule takes part in the rate determining step.
- Kinetic study of reaction shows 1st order reaction. Rate = k [Alkyl halide]

12. Explain mechanism of S_N2 reaction. (Rwp 10)

Ans. Mechanism of S_N2 Reaction

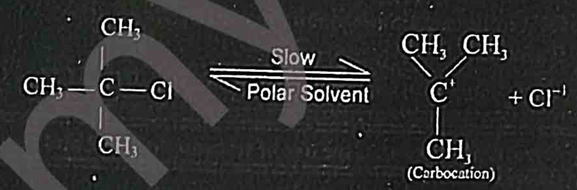


- It is a single step mechanism. The extent of bond formation is equal to the extent of bond breakage.
- There is 100% inversion of configuration from alkyl halide into the product molecule.
- It is a bimolecular reaction as two molecules i.e. substrate and attacking nucleophile take part in the rate determining step.
- Kinetic study of reaction shows 2nd order reaction. Rate = k [substrate] [attacking nucleophile]
- Usually primary alkyl halides follow S_N2 mechanism.

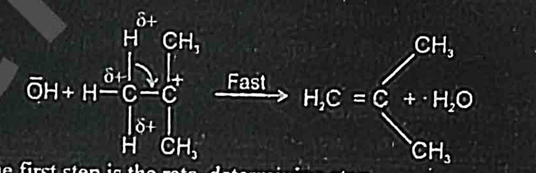
13. Give mechanism of E1 reaction. (Rwp 09)(LHR 12)

Ans. Mechanism of E1 Reaction

First Step:



Second Step:



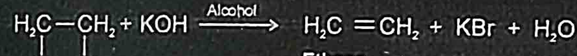
- It is a two steps mechanism. The first step is the rate–determining step.
- The mechanism is called unimolecular (molecularity is one) because only one molecule takes part in the rate determining step.
- Kinetic study of reaction shows 1st order reaction. Rate = k [Alkyl halide]
- Tertiary alkyl halides when attacked by a nucleophile always follow E1 mechanism.

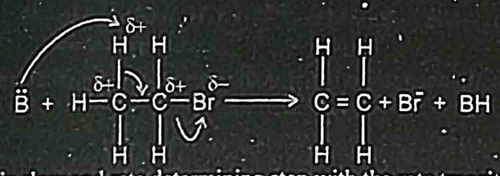
14. Discuss E2 mechanism.

Ans. Mechanism of E2 Reaction

"One step elimination reaction in which both the atoms or groups leave simultaneously is called E2 reaction".

Example:





- Single step reaction which is slow and rate determining step with the rate transition state.
- Bimolecular reaction as two molecules are taking part in the rate determining step. Rate = k[alkyl halide] [base]
- Chemical kinetics shows that it is 2nd order reaction.
- Usually primary alkyl halides follow E2 mechanism.

15. How tetraethyl lead can be prepared from an alkyl halide? (D.G Khan 09)

Ans. Preparation of Tetraethyl Lead

Ethyl chloride reacts with sodium lead alloy giving tetraethyl lead. This compound is an important anti-knock agent and is used in gasoline.

bhattiAcademy

$$4CH_3CH_2Cl + Na_4Pb \longrightarrow \underset{\text{Tetraethyl lead (TEL)}}{(CH_3CH_2)_4\,Pb} + 4NaCl$$

16. What is Wurtz synthesis? How will you convert C_2H_5Cl to n-Butane? (Fsd 10)

Ans. Wurtz Synthesis

"A reaction in which alkyl halides are converted into alkanes by treating with sodium metal in ether is called Wurtz Synthesis."

$$\underset{\text{Alkyl halide}}{2R-X} + 2Na \xrightarrow{\text{Ether}} \underset{\text{Alkane}}{R-R} + 2NaX$$

This reaction is particularly useful for preparation of symmetrical alkanes.

Conversion of C_2H_5Cl to n-Butane:

$$CH_3-CH_2-Cl + 2Na + Cl-CH_2-CH_3 \xrightarrow{\text{Ether}} \underset{\text{n - Butane}}{CH_3-CH_2-CH_2-CH_3} + 2NaCl$$

17. How will you prepare tetramethyl lead? Give use of tetramethyl lead and tetraethyl lead.

Ans. Preparation of Tetramethyl Lead

Methylchloride reacts with sodium lead alloy giving tetramethyl lead.

$$4CH_3Cl + Na_4Pb \longrightarrow \underset{\text{Tetramethyl lead}}{(CH_3)_4\,Pb} + 4NaCl$$

Use of tetramethyl lead and tetraethyl lead:

These compounds are important anti – knocking agents and are used in gasoline.

18. What are Grignard's reagents? Give example. (D.G Khan 09)

Ans. Grignard's Reagent

Grignard reagents (RMgX) are derivatives of alkyl halides belonging to class of organo-metallic compounds.

- Grignard reagent was first prepared by Victor Grignard in 1900.
- These reagents are so important in organic chemistry that almost all the classes of organic compounds can be prepared from them.

Example:

CH_3MgBr (Methylmagnesiumbromide)

CH_3CH_2MgBr (Ethylmagnesiumbromide)

19. Write two methods of preparation of Grignard Reagents. (Rwp 09)

Ans. Preparation methods of Grignard Reagents

(i) When ethylbromide is treated with magnesium metal in the presence of dry ether, ethylmagnesium bromide is formed.

$$CH_3-CH_2-Br + Mg \xrightarrow{\text{Ether}} \underset{\text{Ethylmagnesiumbromide}}{CH_3-CH_2-Mg-Br}$$

(ii) When methylbromide is treated with magnesium metal in the presence of dry ether, methylmagnesium bromide is formed.

$$CH_3-Br + Mg \xrightarrow{\text{Ether}} \underset{\text{Methylmagnesiumbromide}}{CH_3-Mg-Br}$$

20. Why dry ether is necessary for preparation of Grignard Reagent?

Ans. Importance of Dry Ether

Grignard reagents are much reactive class of organic compounds due to $^{\delta-}C - Mg^{\delta+}$ bond polarity. They immediately react with moisture or any impurity (alcohlic contents) and decomposed into alkanes. Since ether is an inert solvent, therefore during the preparation of Grignard reagents ether must be absolutely dry and pure.

$$R^{\delta+}-X^{\delta-} + Mg \xrightarrow{\text{Ether}} R-Mg-X$$

21. Using ethyl bromide as starting material how would you prepare the following compounds? Give also the inorganic reagents and necessary conditions. (Fsd 09)
(a) Ethane (b) Ethene

Ans. Conversion of Ethyl Bromide into

(a) Ethane:

Ethyl bromide when react with Zn dust in the presence of halogen acid forms ethane.

$$CH_3CH_2Br + Zn + H^+ + Br^- \longrightarrow \underset{\text{Ethane}}{CH_3-CH_3} + ZnBr_2$$

(b) Ethene:

Ethyl bromide reacts with KOH in the presence of alcohol to form ethene (dehydrohalogenation).

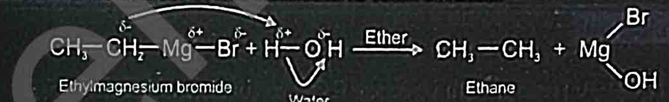
$$CH_3CH_2Br + KOH \xrightarrow{\text{Alcohol}} \underset{\text{Ethene}}{H_2C=CH_2} + KBr + H_2O$$

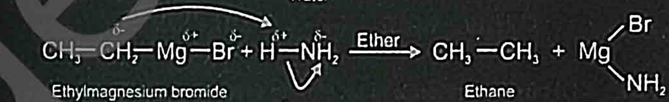
22. What are two applications of Grignard's reagent? (Rwp 07)

Ans. Applications of Grignard's Reagent

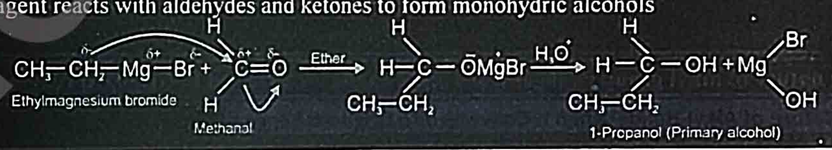
Grignard's reagent is so reactive that almost all the classes of organic compounds can be prepared from them.

(i) Grignard reagent reacts with water, alcohol and ammonia to form alkanes.





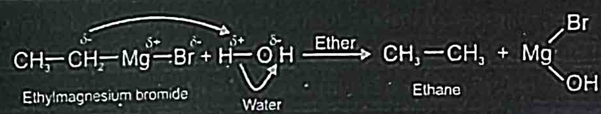
(ii) Grignard's reagent reacts with aldehydes and ketones to form monohydric alcohols



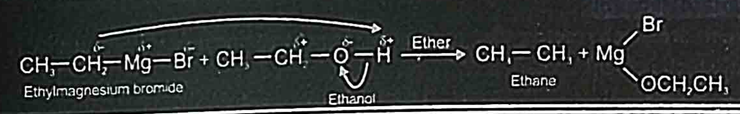
23. What type of products obtained when Grignard's reagent reacts with: (Sgr 09)
(a) Water (b) Ethyl alcohol

Ans. Reactions of Grignard Reagent with

(a) Water:



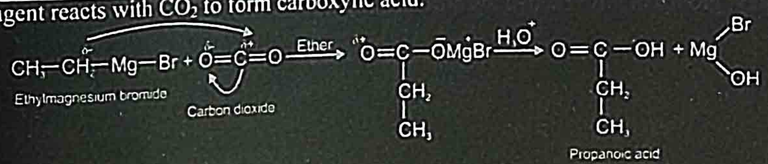
(b) Ethyl alcohol



24. Write down the reaction of Grignard reagent with CO_2. (Sgr 09)

Ans. Reaction of Grignard Reagent with CO_2

Grignard reagent reacts with CO_2 to form carboxylic acid.

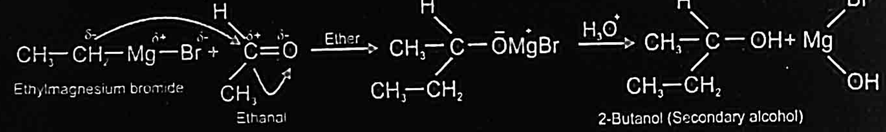


bhattiAcademy

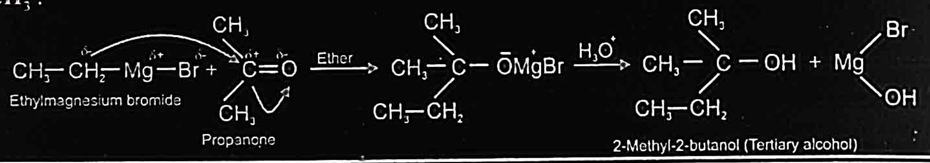
25. What products are formed when the ethyl magnesium bromide is treated with the following?
(a) CH_3CHO (b) CH_3COCH_3 : (Grw 05)

Ans. Reaction of Ethyl Magnesium Bromide with

(a) CH_3CHO:



(b) CH_3COCH_3 :



26. How does ethyl bromide react with: (i) Aqueous KOH (ii) Alcoholic KOH

Ans. Reaction of Ethyl Bromide with

(i) Aqueous KOH:

Ethyl bromide (CH_3CH_2Br) reacts with aqueous KOH to form ethylalcohol (S_N2 reaction).

$$C_2H_5Br + KOH_{(aq)} \longrightarrow C_2H_5OH + KBr$$

(ii) Alcoholic KOH:

Ethyl bromide reacts with KOH in the presence of alcohol to give ethene (E2 reaction).

$$CH_3CH_2Br + KOH \xrightarrow{\text{Alcohol}} H_2C = CH_2 + KBr + H_2O$$

Ethene

27. How the nature of alkyl group changes when alkyl halide is converted to Grignard reagent?

Ans. Change of Nature of Alkyl Halide when it Converts into Grignard Reagent

Alkyl halide reacts with magnesium in dry ether (alcohol free, moisture free), it gives Grignard's reagent.

$$CH_3\overset{\delta+}{C}H_2Br + Mg \xrightarrow[\delta-]{\text{Dry Ether}} CH_3\overset{\delta+}{C}H_2MgBr$$

In alkyl halide, carbon atom is attached with halogen atom which is more electronegative than carbon. So, carbon bears a **partial positive charge** and acts as an electrophilic centre. It is available for nucleophilic attack. While in Grignard reagent, magnesium metal which is more electropositive due to which carbon bears a **partial negative charge** and acts as a nucleophilic centre. This carbon is available for electrophilic centre.

28. Grignard reagents are so reactive organic compounds. Justify.

Ans. Reactivity of Grignard Reagents

Grignard reagents are much reactive than most of the organic compounds. The reactivity is due to the nature of C — Mg bond which is highly polar.

$$CH_3 - H_2C^{\delta-} - Mg^{\delta+} - X^{\delta-}$$

Magnesium is more electropositive (E.N = 1.2) than carbon (E.N = 2.5) and the C—Mg bond though covalent is highly polar, giving alkyl carbon the partial negative charge. This negative charge is an unusual character which makes the alkyl groups highly reactive towards electrophilic centers.

****

CHAPTER 11

ALCOHOLS, PHENOLS AND ETHERS

Solved Objective Exercise

Q1. Fill in the blanks.

(i). Primary, secondary and tertiary alcohols can be identified by ____ test.
(ii). Oxidation of ____ alcohols give ketones.
(iii). Alcohols on heating with ____ give alkenes at high temperature.
(iv). Alcohols have ____ boiling points than ethers due to stronger hydrogen bonding.
(v). Williamson's synthesis is used to prepare ____.
(vi). ____ is also called wood spirit.
(vii). Carbolic acid is the other name of ____.
(viii). Primary, secondary and tertiary alcohols can be prepared by reacting Grignard reagent with ____.
(ix). Alcohols and ____ react to produce esters.
(x). ____ is used as anti- freezing agent in automobile radiator.
(xi). The process of conversion of starch into alcohol with the help of micro – organisms is called ____.
(xii). Ketones on reduction give ____ alcohols.

Answer Key.

(i)	Lucas	(ii)	Secondary
(iii)	Conc.H_2SO_4	(iv)	Higher
(v)	Ethers	(vi)	Methyl alcohol
(vii)	Phenol	(viii)	Carbonyl compounds
(ix)	Carboxylic acids	(x)	Methyl alcohol
(xi)	Fermentation	(xii)	Secondary

Q2. Indicate True or false.

(i). Methylated spirit contains 95% methyl alcohol and 5% ethyl alcohol.
(ii). Ethyl alcohol is a very good anti-freezing agent.
(iii). Methanol is also called wood spirit.
(iv). Only 14% ethyl alcohol can be prepared by fermentation.
(v). Ethers do not show hydrogen bonding.
(vi). Alcohols are more acidic than phenols.
(vii). Phenol is more soluble in water than lower alcohols.

bhatti Academy

(viii). Alcohols are more basic than ethers.
(ix). Ethers have higher boiling point than alcohols and phenols.
(x). Methanol and ethanol can be distinguished by iodoform test.

Answer Key.

(i)	False	(ii)	False	(iii)	True	(iv)	True	(v)	True
(vi)	False	(vii)	False	(viii)	False	(ix)	False	(x)	True

Q3. Multiple Choice Questions. Encircle the correct answer.

(i). Which compound shows hydrogen bonding?
(a) C_2H_6 (b) C_2H_5Cl (c) CH_3-O-CH_3 (d) C_2H_5OH

(ii). Which compound show maximum hydrogen bonding with water?
(a) CH_3OH (b) C_2H_5OH (c) CH_3-O-CH_3 (d) C_6H_5OH

(iii). Which compound is more soluble in water?
(a) C_2H_5OH (b) C_6H_5OH (c) CH_3COCH_3 (d) n- Hexanol

(iv). Which compound will have the maximum repulsion with H_2O?
(a) C_6H_6 (b) C_2H_5OH (c) $CH_3CH_2CH_2OH$ (d) $CH_3 - O - CH_3$

(v). Ethanol can be converted into ethanoic acid by
(a) Hydrogenation (b) Hydration (c) Oxidation (d) Fermentation

(vi). Which enzyme is not involved in fermentation of starch?
(a) Diastase (b) Zymase (c) Urease (d) Invertase

(vii). Which compound is called a universal solvent?
(a) H_2O (b) CH_3OH (c) C_2H_5OH (d) $CH_3—O—CH_3$

(viii). Methyl alcohol is not used.
(a) as a solvent (b) as an anti- freezing agent
(c) as a substitute for petrol (d) for denaturing of ethyl alcohol

(ix). Rectified spirit contains alcohol about
(a) 80% (b) 85% (c) 90% (d) 95%

(x). According to Lewis concept ethers behave as.
(a) Acid (b) Base (c) Acid as well as base (d) None of them

Solved Exercise MCQ's

Q.No.	Answer	Reason
(i).	(d) C_2H_5OH	Image Structure
(ii).	(a) CH_3OH	Image Structure
(iii).	(a) C_2H_5OH	Due to hydrogen bonding with H_2O it is soluble in water.
(iv).	(a) C_6H_6	Image Structure Benzene is non-polar while H_2O is polar so C_6H_6 (benzene) is insoluble in water.
(v).	(c) Oxidation	$C_2H_5OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3CHO \xrightarrow{[O]} CH_3COOH$ (Ethanol) (Ethanoic acid)

(vi).	(c) Urease	$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow{\text{Diastase}} nC_{12}H_{22}O_{11}$ $C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Maltase}} 2C_6H_{12}O_6$ $C_6H_{12}O_6 \xrightarrow{\text{Zymase}} 2C_2H_5OH + 2CO_2$
(vii).	(a) H_2O	Water dissolves almost all compounds except some organic compounds so it is a universal solvent.
(viii).	(c) As a substitute for petrol	It is used as solvent, as an antifreezing agent and also for denaturating of ethylalcohol.
(ix).	(d) 95%	Rectified spirit is an azeotropic mixture.
(x).	(b) Base	Ether can give lone pair of electrons so they are Lewis base.

Previous Boards MCQ's

1. Phenol-formaldehyde resin is called (D.G Khan 2008)
(a) Bakelite (b) Teflon (c) Orlon (d) Terylene

2. Carbon atom in dimethylether is (D.G Khan 2009)
(a) sp-hybridized (b) sp^2-hybridized (c) sp^3- hybridized (d) None

3. Methanol is also called (D.G Khan 2009)
(a) Wood spirit (b) Methylated spirit (c) Rectified spirit (d) Absolute alcohol

4. According to Lewis concept ethers are (D.G Khan 2010)
(a) Acids (b) Bases (c) Acids as well as bases (d) Neither acids nor bases

5. Which of the following reagent will replace –OH group of alcohol by a halogen atom
(a) HOCl (b) Br_2 (c) $SOCl_2$ (d) I_2

6. Which of the following possess higher boiling point? (Rwp 2009)
(a) Methanol (b) Ethanol (c) Methylchloride (d) Glycol

7. Tertiary alcohol is obtained by treating Grignard reagent with (Rwp 2010)
(a) HCHO (b) CH_3CHO (c) CH_3COCH_3 (d) CO_2

8. Alcohol obtained by fermentation never exceeds (Fsd 2008) – (Lhr 09)) – (Grw 12)
(a) 14% (b) 10% (c) 16% (d) 95%

9. Rectified spirit contains alcohol about (Fsd 2009) (Srg 2010)
(a) 80% (b) 85% (c) 90% (d) 95%

10. Ethanol and methanol can be distinguished by (Fsd 2010)
(a) Iodoform test (b) Lucas test (c) Benedict's test (d) Tollen's test

11. The optimum temperature for fermentation is (Fsd 2010)
(a) 10 – 20°C (b) 15 – 25°C (c) 20 – 30°C (d) 25 – 35°C

12. Molasses undergo fermentation in the presence of enzymes (Fsd 2010)
(a) Invertase and zymase (b) Diastase and maltase
(c) Zymase and sucrose (d) Lactase and amylase

13. Which enzyme is not involved in fermentation of starch? (Sgr 2009)
(a) Diastase (b) Zymase (c) Urease (d) Invertase

14. Methyl alcohol is not used (Grw 2008)
(a) Aas a solvent (b) As an antifreezing agent
(c) As a substitute for petrol (d) For denaturing of ethyl alcohol

15. Which compound is called universal solvent? (Grw 2009) – (Lhr 12)
(a) H_2O (b) CH_3OH (c) C_2H_5OH (d) $CH_3 – O – CH_3$

16. Compound showing maximum repulsion with H_2O is (Grw 2010)
(a) C_6H_6 (b) C_2H_5OH (c) $CH_3CH_2CH_2OH$ (d) CH_3OCH_3

bhattiAcademy

17. Which liquid is called wood spirit? (Grw 2011)
(a) CH_3OH (b) C_2H_5OH (c) CH_3COOH (d) CH_3-O-CH_3

18. Which compound is more soluble in water (Lhr 2010)
(a) CH_3OH (b) C_2H_5OH (c) CH_3COCH_3 (d) n – hexanol

19. Methanol can be prepared from hydrogenation of (Lhr 2011)
(a) CH_3CN (b) CH_3Br (c) HCHO (d) CH_3CHO

20. The compound which is more soluble in water. (Fsd 2012)
(a) C_6H_5OH (b) C_2H_5OH (c) $C_6H_{13}OH$ (d) $C_7H_{15}OH$

21. Order of reactivity of alcohols when C – O bond breaks is: (Lhr 2012)
(a) Tertiary alcohols > Secondary alcohols > Primary alcohols
(b) Primary alcohols > Secondary alcohols > Tertiary alcohols
(c) Secondary alcohols > Primary alcohols > Tertiary alcohols
(d) Tertiary alcohols > Primary alcohols > Secondary alcohols

Entry Test MCQ's

1. Which of the following tests is used to distinguish pri, sec and ter alcohols:
(a) Baeyer's test (b) Lucas test
(c) Tollen's reagent test (d) Schiff's reagent test

2. Consider the following structure $CH_2OHCHOHCH_2OH$ correct name of the above structure is
(a) ethylene glycol (b) propylene glycol
(c) glycerol (d) ter.propyl glycol

3. Which of the following tests is used to distinguish between methyl alcohol and ethyl alcohol
(a) Fehling's solution test (b) Br_2/H_2O test
(c) Tollen's reagent test (d) Iodoform test

4. Which of the following is the most reactive alcohol when bond is to be broken between C- O
(a) $CH_3-CH_2-CH_2-CH_2-OH$ (b) $CH_3-CH_2-CH_2-OH$
(c) $CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$ (d) $(CH_3)_3COH$

5. Absolute alcohol may be obtained from rectified spirit by the use of
(a) Calcium chloride (b) Mg (c) Benzene (d) CaO

6. Ethers are stored in brown bottles. This is because on exposure to air and light ethers are converted to
(a) Peroxides (b) Oxonium ions (c) Ozonides (d) Electrophiles

7. Williamson's synthesis is used to prepare:
(a) Acetone (b) Ethers (c) PVC (d) Bakelite

8. An industrial method of preparation of methanol is:
(a) Catalytic reduction of carbon monoxide in presence of ZnO and Cr_2O_3
(b) By reacting methane with steam at 900°C with a nickel catalyst
(c) By reducing formaldehyde with lithium aluminium hydride
(d) By reacting formaldehyde with aqueous sodium hydroxide solution

9. The highest boiling point stand for:
(a) Primary alcohols (b) Secondary alcohols (c) Tertiary alcohols (d) None

10. Diethylether may behave as:
(a) Lewis acid (b) Lewis base (c) Oxidizing agent (d) Reducing agent

11. In cold countries ethylene glycol is added in the water in the radiators of cars during winters. This result in
(a) Lowering in freezing point (b) Reducing the viscosity
(c) Reducing the specific heat (d) Making water a better conductor of electric

12. When CH_3MgBr is made to react with acetone and the addition product is hydrolysed we get:
(a) Primary alcohols (b) Secondary alcohols (c) Tertiary alcohols (d) An aldehyde

13. Ethyl alcohol on oxidation with $K_2Cr_2O_7$ gives:
(a) Formic acid (b) Formaldehyde (c) Acetic acid (d) Acetaldehyde

14. Which of the following alcohol is least soluble in water
(a) CH_3OH (b) $CH_3CH_2CH_2OH$ (c) CH_3CH_2OH (d) $CH_3CH_2CH_2CH_2OH$

15. Alcohols may behave as:
(a) Bronsted Acid (b) Oxidizing agent (c) Lewis base (d) Reducing agent

16. A plastic bakelite is a compound of HCHO with:
(a) Benzene (b) Phenol (c) Ammonia (d) Hydrocarbon

17. 100% pure ethyl alcohol is known as:
(a) Power alcohol (b) Methylated spirit (c) Absolute alcohol (d) Rectified alcohol

18. Which of the following type of alcohol is more reactive when bond is to be broken between O-H
(a) CH_3OH (b) $CH_3-CH_2-O-CH_2-CH_3$ (c) CH_3CH_2OH (d) $(CH_3)_3COH$

19. Which of the following tests indicate the presence of –OH group
(a) Action of sodium (b) Acylation (c) Action of PCl_5 (d) All of the above

20. Germinated barley called malt, is source of enzyme:
(a) Zymase (b) Maltase (c) Diastase (d) Invertase

21. Which alcohol is more acidic
(a) t-butyl alcohol (b) Ethyl alcohol (c) Methyl alcohol (d) Isopropyl alcohol

Additional MCQ's

1. The formula $(CH_3)_3COH$ having IUPAC name :
(a) 2 - Methyl – 2- propanol (b) Ter-butyl alcohol
(c) Both a and b (d) 2- butanol

2. For denaturing of alcohol a small quantity of ____ may be added:
(a) Acetone (b) Pyridine (c) Water (d) Both a and b

3. Picric acid is a _____which behaves like an acid:
(a) Ether (b) Alcohol (c) Alkane (d) None of these

4. The solubility of alcohols is due to:
(a) Hydrogen bonding (b) Covalent bond
(c) Coordinate covalent bond (d) Dipole – dipole forces

5. The order of reactivity of alcohols when O-H bond breaks:
(a) Tertiary alcohol > Secondary alcohol > Primary alcohol
(b) Primary alcohol > Secondary alcohol > Tertiary alcohol
(c) CH_3OH > Primary alcohol > Secondary alcohol > Tertiary alcohol
(d) None of these

6. If a nucleophile attacks, then it is _____ bond which breaks:
(a) C – O bond (b) O – H bond (c) C – C bond (d) H – H bond

7. If an electrophile attacks, then it is _____ bond which breaks:
(a) C – O bond (b) O – H bond (c) C – C bond (d) H – H bond

8. Phenols can undergo _____ reactions easily
(a) Nucleophilic substitution (b) Electrophilic substitution

bhattiAcademy

(c) Electrophilic addition (d) Nucleophilic addition

9. **Phenol is acidic in nature because of:**
(a) – OH group (b) Benzene ring (c) Hydrogen bond (d) Stability of phenoxide ion

10. **Relative acidic strength of alcohol, phenol, carboxylic acid and H_2O is in the order:**
(a) Phenol > alcohol > water > carboxylic acid (b) Carboxylic acid > phenol > water > alcohol
(c) Alcohol > water > phenol > carboxylic acid (d) All are correct

11. **Which of the following statement is true about phenols?**
(a) It turns blue litmus paper red (b) It evolves CO_2 from carbonates
(c) It readily dissolves in alkalies (d) Both b and c.

12. **Hydrogenation of phenol gives_____:**
(a) Cyclohexanol (b) Cyclohexene (c) Cyclohexane (d) Benzene

13. **Which of the following statement is true about ethers:**
(a) Ethers are less volatile and high boiling liquids (b) Ethers are fairly soluble in water
(c) Ethers are acidic in nature (d) Ethers are volatile and low boiling liquids

14. **Common name of 2, 3-Dihydroxybutane –1, 4 – dioic acid is:**
(a) Citric acid (b) Tartaric acid (c) Ascorbic acid (d) Lactic acid

15. **Common name of 2- Hydroxy propanoic acid is:**
(a) Citric acid (b) Tartaric acid (c) Ascorbic acid (d) Lactic acid

16. **Mixture of CO and H_2 is called:**
(a) Hydrocarbon (b) Water gas (c) None (d) Both a and b

17. **Catalyst used in industrial preparation of methanol is:**
(a) V_2O_5 (b) Al_2O_3 (c) Cr_2O_3 (d) Pt

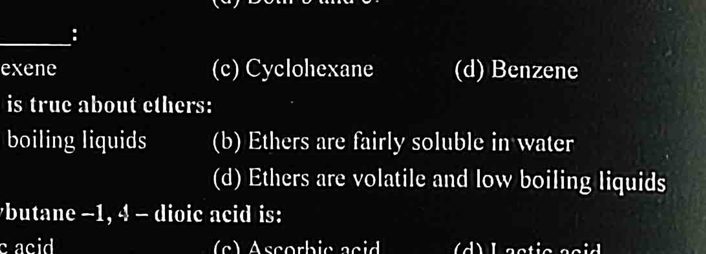
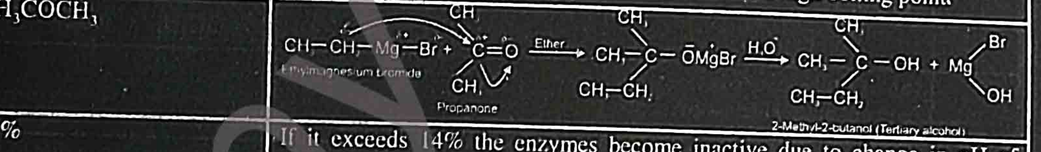
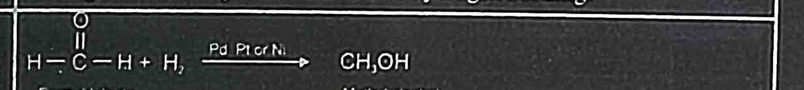
18. **R - O - R ether will react readily with:**
(a) HBr (b) HI (c) HF (d) HCl

19. **All produce ethyl alcohol on fermentation except:**
(a) Molasses (b) Fruit juices (c) Cholesterol (d) Starch

20. **Oxidation of methanol produces:**
(a) Ethanol (b) Methanol (c) Methanal (d) Mixture of methanal and H_2O

ANSWERS TO MCQ'S

Previous Board MCQ's

Q.No.	Answer	Reason
1.	(a) Bakelite	 (Bakelite)
2.	(c) sp^3 hybridized	$H_3C - O - CH_3$ (Since C – Atom is attached with four other atoms, so it is sp^3 – hybridized.)
3.	(a) Wood spirit	Formerly methanol was prepared by distillation of wood. That is why it is also called as wood spirit.
4.	(b) bases	Ethers have lone pair of electron on oxygen and can donate so they are Lewis bases.
5.	(c) $SOCl_2$	$CH_3OH + SOCl_2 \rightarrow CH_3Cl + SO_2 + HCl$
6.	(d) Glycol	It has two hydrogen bonding per molecule so it has high boiling point.
7.	(c) CH_3COCH_3	
8.	(a) 14%	If it exceeds 14% the enzymes become inactive due to change in pH of solution.
9.	(d) 95%	Rectified spirit is an azeotropic mixture.
10.	(a) Iodoform test	CH_3OH (Methanol) does not react with alkaline iodine while CH_3CH_2OH give yellow coloured crystals.
11.	(d) 20 – 35°C	The optimum temperature for fermentation is 27° C.
12.	(a) Invertase and Zymase	$C_{12}H_{11}O_{22} + H_2O \xrightarrow{Invertase} C_6H_{12}O_6 + C_6H_{12}O_6$ (Molasses) (Glucose) (Fructose)
13.	(c) Urease	$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow{Diastase} nC_{12}H_{22}O_{11}$ $C_{12}H_{22}O_{11} + H_2O \xrightarrow{Maltase} 2C_6H_{12}O_6$ $C_6H_{12}O_6 \xrightarrow{Zymase} 2C_2H_5OH + 2CO_2$
14.	(c) As a substitute for petrol	It is used as antifreezing, as solvent as well as denaturating of alcohol.
15.	(a) H_2O	H_2O dissolves almost all the compounds except some organic compounds so it is a universal solvent.
16.	(a) C_6H_6	Benzene is non-polar so it shows maximum repulsion with water because H_2O is polar.
17.	(a) CH_3OH	Formally it is prepared by distillation of wood that is why it is called wood spirit.
18.	(a) CH_3OH	It has greatest affinity with water due to hydrogen bonding.
19.	(c) HCHO	
20.	(b) C_2H_5OH	Due to strong hydrogen bonding with water it is more soluble.
21.	(a) Tertiary alcohol > Secondary alcohol > Primary alcohol	Order is due to stability of the carbocations. Stability Order: Ter. Carbocation > Sec. carbocation > Primary carbocation.

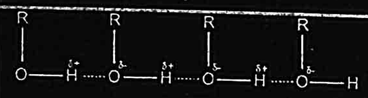
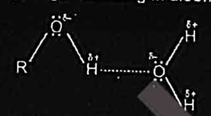
Entry Test MCQ's

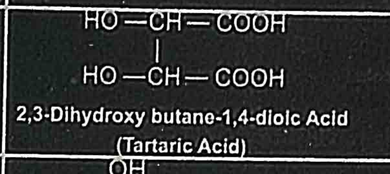
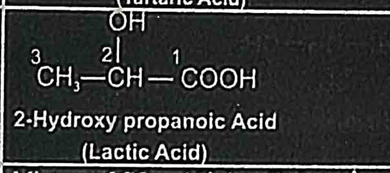
Q.No.	Answer	Reason
1.	(b) Lucas test	Pri-alcohol gives oily layer on heating, sec-alcohol gives oily layer in 5 – 10 minutes while Ter-alcohol immediately gives oily layer with Lucas reagent.
2.	(c) Glycerol	It is highly soluble in water.
3.	(d) Iodoform Test	$CH_3OH + NaOH + I_2 \longrightarrow$ No reaction $CH_3CH_2OH + 6NaOH + 4I_2 \longrightarrow CHI_3 + 5NaI + HCOONa + 5H_2O$ Yellow coloured crystals of iodoform

Bhatti Academy

4.	(d) $(CH_3)_3COH$	Tertiary alcohol is most reactive because its carbocation is more stable.
5.	(d) CaO	CaO is dehydrating agent and after adding it absorbs about 1% moisture and solution becomes zeotropic.
6.	(a) Peroxides	On exposure to sunlight, ethers are converted to peroxides.
7.	(b) Ethers	$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5O^-Na^+ + H_2$ $C_2H_5O^-Na^+ + C_2H_5Br \longrightarrow C_2H_5OC_2H_5 + NaBr$
8.	(a) Catalytic reduction of carbon monoxide in presence of $ZnO+Cr_2O_3$	$2H_2 + CO \xrightarrow[450^\circ C/200 atm]{ZnO+Cr_2O_3} CH_3OH$
9.	(a) Primary alcohols	In primary alcohols, intermolecular forces are strong due to straight chain so they have high boiling point.
10.	(b) Lewis base	$CH_3 - O - CH_3$, It can give lone pairs.
11.	(a) Lowering in freezing point	Due to interaction of solute and solvent, freezing point of solution decreases.
12.	(c) Tertiary alcohols	Ketones on reaction with Grignard reagent, give tertiary alcohols.
13.	(d) Acetaldehyde	$CH_3 - CH_2OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3 - CHO + H_2O$ Ethanal (acetaldehyde)
14.	(d) $CH_3CH_2CH_2CH_2OH$	Solubility of alcohols decreases with increase in carbon number because hydrogen bonding in higher alcohol is less prominent than lower.
15.	(a) Bronsted acid	It can give proton H^+.
16.	(b) Phenol	Phenol + HCHO $\longrightarrow$ Bakelite
17.	(c) Absolute alcohol	Absolute $\rightarrow$ 100% pure.
18.	(a) CH_3OH	It is more reactive because methoxide ion (CH_3O^-) is more stable.
19.	(c) PCi_5	$CH_3OH + PCl_5 \rightarrow CH_3Cl + POCl_3 + HCl$
20.	(b) Maltase	Name of enzyme is usually derived from substrate malt
21.	(c) Methyl alcohol	It easily gives H^+ because methoxide ion is more stable so it is most acidic.

Additional MCQ's

Q.No.	Answer	Reason
1.	(a) 2-Methyl – 2- Propanol	Its an IUPAC name.
2.	(d) Both a and b	Small quantity of pyridine and acetone can be added.
3.	(d) None of these	It is derivative of phenol.
4.	(a) Hydrogen bonding	 Hydrogen bonding in alcohol  Hydrogen bonding between water and alcohol
5.	(c) CH_3OH > Primary alcohol > Sec. alcohol > Ter alcohol	Stability of alkoxide ion $(R-O^-)$ decreases from (CH_3-O^-) and so on. Thus reactivity decreases.
6.	(a) C – O bond	When C – O bond breaks OH^- (Nucleophile) is replaced by other nucleophile like Cl^-.

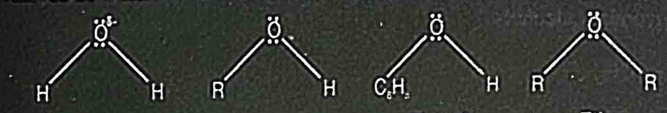
7.	(b) O – H bond	When O – H bond breaks, oxide ion is formed on which electrophile attacks.
8.	(b) Electrophilic substitution	NO_2^+ (electrophile) subtitute hydrogen from ring.
9.	(d) Stability of phenoxide ion	Phenoxide ion is stable due to resonating structure.
10.	(b) Carboxylic acid > Phenol > water > Alcohol	Substance / Ka Carboxylic acids / 10^{-4} Phenol / 1.3×10^{-10} Water / 10^{-14} Alcohols / 10^{-16} - 10^{-18}
11.	(c) It readily dissolves in alkalies	This shows that it is slightly acidic.
12.	(a) Cyclohexanol	
13.	(d) Ethers are volatile and low boiling liquid.	Due to weak intermolecular forces.
14.	(b) Tartaric acid	 2,3-Dihydroxy butane-1,4-diolc Acid (Tartaric Acid)
15.	(d) Lactic acid	 2-Hydroxy propanoic Acid (Lactic Acid)
16.	(b) Water gas	Mixture of CO and H_2 is called water gas.
17.	(c) Cr_2O_3	$CO + 2H_2 \xrightarrow[450^\circ C: 200 atm]{(ZnO + Cr_2O_3)} CH_3OH$
18.	(b) HI	HI is more reactive due to large bond length and weak bond.
19.	(c) Cholesterol	Cholesterol is an important steroid.
20.	(d) Mixture of Methanal and H_2O	$CH_3OH + 2[O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} HCHO + H_2O$

Short Answers Questions

1. Name the organic compounds which are considered as derivatives of water. (FSD 08)

Ans. Organic Compounds considered as derivatives of water

Alcohols, phenols and ethers are classes of organic compounds which are more closer to water in structure and hence considered as derivatives of water.



Academy

2. What are alcohols? Give their classification. (Sgr 10)

Ans. Alcohols

"Organic compounds containing hydroxyl group (–OH) as functional group are called alcohols."

They are represented by a general formula R-OH.

Classification of Alcohols

Alcohols are classified into

(i) Monohydric Alcohols:

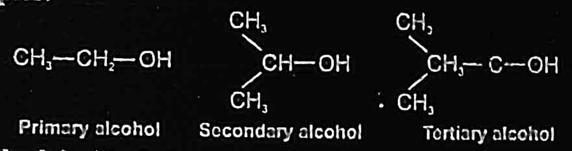
The alcohols containing one hydroxyl group – OH are called monohydric alcohols.

They are further classified into:

(a) Primary Alcohols
(b) Secondary Alcohols
(c) Tertiary Alcohols

In primary alcohols, –OH functional group is attached with primary carbon atom, in secondary alcohols with secondary carbon atom and in tertiary alcohols it is attached with a tertiary carbon atom.

Examples:

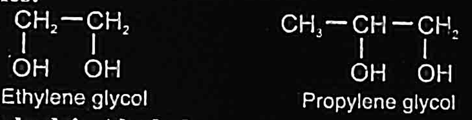


Primary alcohol | Secondary alcohol | Tertiary alcohol

(ii) Dihydric Alcohols:

The alcohols containing two hydroxyl groups (–OH) are called dihydric alcohols.

Examples:



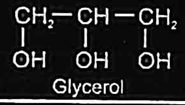
Ethylene glycol

Propylene glycol

(ii) Polyhydric Alcohols:

The alcohols containing more than two hydroxyl groups (–OH) are called polyhydric alcohols.

Examples:



Glycerol

3. What are monohydric alcohols? Give classification.

Ans. Monohydric Alcohols

The alcohols containing one hydroxyl group (–OH) are called monohydric alcohols.

They are further classified into:

(i) Primary Alcohols:

"Monohydric alcohols in which –OH group is attached with primary carbon are called primary alcohols."

Examples:

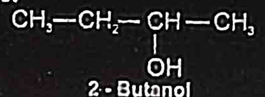
CH_3OH CH_3CH_2OH

Methanol Ethanol

(ii) Secondary Alcohols:

"Monohydric alcohols in which (–OH) group is attached with secondary carbon are called secondary alcohols."

Example:

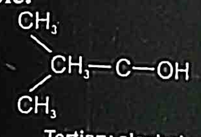


2 - Butanol

(iii) Tertiary Alcohols:

"Monohydric alcohols in which –OH group is attached with tertiary carbon are called tertiary alcohols."

Example:



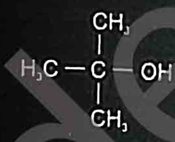
Tertiary alcohol

4. Write IUPAC names of the following compounds. (Sgr 09)(D.G Khan 09)

(a) $(CH_3)_3C\text{-}OH$ (b) $C_2H_5-CH(CH_3)-OH$

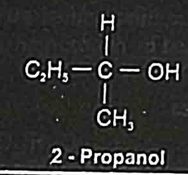
Ans. IUPAC names of

(a) $(CH_3)_3C\text{-}OH$



2 - Methyl - 2 - propanol

(b) $C_2H_5-CH(CH_3)-OH$



2 - Propanol

5. What are the isomers of C_2H_6O and write their IUPAC names.

Ans. Isomers of C_2H_6O and their IUPAC names

Structure	IUPAC Name	Common Name
(i) CH_3-O-CH_3	Methoxymethane	Dimethylether
(ii) CH_3-CH_2-OH	Ethanol	Ethyl alcohol

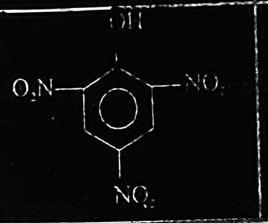
- Methoxy methane and ethanol are functional group isomers of each other.

6. Write down structural formulas of: (LHR 12, Grw 12)
(a) Ethylene Glycol (b) Lactic Acid (c) Tartaric Acid
(d) Carbolic Acid (e) Picric Acid

Ans. Structural Formulas of

Compound Name	Structure	IUPAC Name
(a) Ethylene Glycol	$CH_2(OH)-CH_2(OH)$	1,2-Ethanediol
(b) Lactic Acid	$CH_3-CH(OH)-COOH$	2-Hydroxy propanoic acid
(c) Tartaric Acid	$HO-CH(COOH)-CH(OH)-COOH$	2, 3-Dihydroxy butane 1,4-dioic acid

bhatti Academy

(d) Carbolic Acid		Hydroxybenzene (Phenol or Benzenol)
(c) Picric Acid		2,4,6-Trinitrophenol

7. Define Fermentation. Give one example. **(Grw 08)**

Ans. Fermentation

"It is a biochemical process which occurs in the presence of certain enzymes secreted by microorganisms such as yeast."

Example:

From Molasses

$$\underset{\text{Molasses}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow[\text{Yeast}]{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

8. Define fermentation. Give necessary conditions for fermentation. **(Grw 08)**

Ans. Fermentation

"It is a biochemical process which occurs in the presence of certain enzymes secreted by microorganisms such as yeast."

Necessary conditions:

(i) Optimum temperature for fermentation is 25-35°C.
(ii) Proper aeration
(iii) Dilution of solution
(iv) Absence of any preservative

9. Differentiate between rectified spirit and absolute alcohol. **(Rwp 09)**

Ans

Rectified Spirit	Absolute Alcohol
∘ 95% ethanol is called rectified spirit. ∘ By fermentation, we get 12-14% alcohol. On further distillation, it converts into rectified spirit. ∘ It is an azeotropic mixture (95% ethanol +5% H_2O).	∘ 100% alcohol is called absolute alcohol. ∘ It is obtained by adding CaO (Lime) in rectified spirit and re-distillation of the mixture. ∘ It is purest form of ethanol.

10. Why absolute alcohol cannot be prepared by fermentation process? **(LHR 09)**
OR Only 14% alcohol can be prepared by fermentation process. Why?

Ans. Absolute alcohol cannot be prepared by Fermentation

Alcohol obtained by fermentation is only upto 12% and never exceeds 14% because beyond this limit enzymes become inactive. This alcohol is distilled again and again to obtain 95% alcohol which is called rectified spirit. It is an azeotropic mixture. Absolute alcohol can be obtained by re-distillation of rectified spirit in the presence of CaO which absorbs its moisture.

Q. How can you prepare ethanol from: (a) Molasses (b) Starch

Ans. Preparation of Ethanol

(a) Molasses

$$\underset{\text{Molasses}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow[\text{Yeast}]{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

$$\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow[\text{Yeast}]{\text{Zymase}} 2C_2H_5OH + 2CO_2$$

(b) Starch

$$\underset{\text{Starch}}{2(C_6H_{10}O_5)_n} + nH_2O \xrightarrow[\text{Yeast}]{\text{Diastase}} \underset{\text{Maltose}}{nC_{12}H_{22}O_{11}}$$

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{Yeast}]{\text{Maltase}} \underset{\text{Glucose}}{2C_6H_{12}O_6}$$

$$\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow[\text{Yeast}]{\text{Zymase}} 2C_2H_5OH + 2CO_2$$

11. What is meant by denaturing of alcohol? **(D.G Khan 09)**

Ans. Denaturing of Alcohol

"The addition of 10% methanol or small quantity of pyridine or acetone in ethanol is called denaturing of alcohol."

- 10% methanol is added in alcohol to avoid its use for drinking purposes such alcohol is called **methylated spirit.**
- A small quantity of pyridine or acetone is also added for this purpose.

12. Write a method for the preparation of methanol. **(LHR 12)**

Ans. Preparation of Methanol

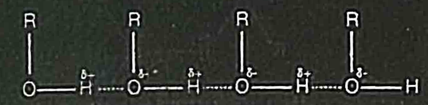
Methanol is prepared from carbon monoxide and hydrogen or water gas as follows:

$$CO + 2H_2 \xrightarrow[450^\circ C:\ 200\ atm]{(ZnO + Cr_2O_3)} CH_3OH$$

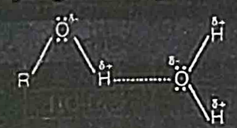
13. The solubility of alcohols decreases with increasing molecular mass. Why?

Ans. Solubility of Alcohols

The solubility of alcohols in water is due to hydrogen bonding. This hydrogen bonding is more prominent in lower alcohols and less prominent in higher alcohols. That's why solubility of alcohols decreases with increasing molecular masses.



Hydrogen bonding in alcohol



Hydrogen bonding between water and alcohol

In higher alcohols, the hydrogen bonding is less prominent due to less polarity of O – H bond.

Bhatti Academy

Examples:

Name	Formula	Solubility
Methanol	CH_3OH	miscible
Ethanol	C_2H_5OH	
Propanol	C_3H_7OH	
Butanol	C_4H_9OH	0.11
Pentanol	$C_5H_{11}OH$	0.030
Hexanol	$C_6H_{13}OH$	0.0058
Heptanol	$C_7H_{15}OH$	0.0008

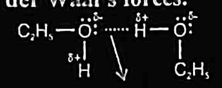
14. Why ethyl alcohol is a liquid while methyl chloride is a gas? (Rwp 09)

Ans. Ethyl Alcohol is Liquid but Methylchloride is a Gas

The physical state of a substance depends upon the strength of intermolecular forces. In liquid state attractive forces are stronger than in gaseous state.

Ethylalcohol – a Liquid:

In C_2H_5OH (ethylalcohol), strong hydrogen bonding is present due to which it exists as liquid. Moreover, it has high polarizability due to which it has strong van der Waal's forces.



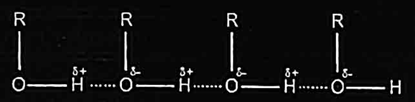
Methylchloride – a Gas:

Less polarizability and weaker attractive forces (dipole-dipole forces) are the main reasons for gaseous state of methylchloride (CH_3Cl).

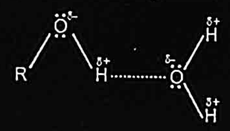
15. Why alcohols are miscible with water? (FSD 08)

Ans. Miscibility of Alcohols in Water

Alcohols are soluble in water due to hydrogen bonding. Lower alcohols are soluble in all proportions. As the length of carbon chain increases in higher alcohols, the hydrogen bonding with water decreases. As a result the solubility also decreases.



Hydrogen bonding in alcohol



Hydrogen bonding between water and alcohol

Examples:

Name	Formula	Solubility
Methanol	CH_3OH	miscible
Ethanol	C_2H_5OH	
Propanol	C_3H_7OH	
Butanol	C_4H_9OH	0.11
Pentanol	$C_5H_{11}OH$	0.030
Hexanol	$C_6H_{13}OH$	0.0058
Heptanol	$C_7H_{15}OH$	0.0008

16. What is the order of reactivity of primary, secondary and tertiary alcohols when C – O bond and O – H bond break? (Mtn 12)

Ans. Reactivity of Alcohols when C – O bond Breaks

If a nucleophile attacks on an alcohol, it is the C—O bond which breaks. As a result a carbocation is formed.

$$CH_3-\overset{\delta+}{C}H_2-\overset{\delta-}{O}H \xrightarrow{\text{Nucleophile}} CH_3-\overset{+}{C}H_2 + OH^-$$

Order of Reactivity:

Tertiary alcohol > Secondary alcohol > Primary alcohol

Reactivity of Alcohols when O – H bond Breaks

If an electrophile attacks on an alcohol, it is the O—H bond which breaks.

$$CH_3-CH_2-\overset{\delta-}{O}-\overset{\delta+}{H} \xrightarrow{\text{Electrphile}} CH_3-CH_2-\bar{O} + H^+$$

Order of Reactivity:

CH_3OH > Primary alcohol > Secondary alcohol > Tertiary alcohol

17. Why primary alcohols especially methanol is more reactive than other alcohols when an electrophile attacks on it? (Mtn 12)

Ans. Reactivity of Primary Alcohols towards Electrophile

When an electrophile attacks on an alcohol, O – H bond breaks and alkoxide ion is formed. The reactivity of alcohols depends upon the stability of alkoxide ions. Greater the stability of alkoxide ion, less will be its reactivity. The order of stability of alkoxide ions is as follows:

$$CH_3-\bar{O} > CH_3-H_2C-\bar{O} > \underset{CH_3}{\overset{CH_3}{HC}}-\bar{O} > \underset{CH_3}{\overset{CH_3}{H_3C-C}}-\bar{O}$$

Methoxide ion > Pri. Alkoxide ion > Sec. Alkoxide ion > Ter. Alkoxide ion

This shows that methanol and other primary alcohols are more reactive towards electrophiles.

18. Give examples of reactions in which C – O bond in alcohols breaks.

Ans. Reactions in which C – O Bond Breaks

1. $\underset{\text{Ethanol}}{C_2H_5OH} + \underset{\text{Thionyl chloride}}{SOCl_2} \xrightarrow{\text{Pyridine}} \underset{\text{Ethyl chloride}}{C_2H_5Cl} + SO_2 + HCl$
2. $C_2H_5OH + HCl \xrightarrow{ZnCl_2} C_2H_5Cl + H_2O$
3. $C_2H_5OH + HNH_2 \xrightarrow{ThO_2} \underset{\text{Ethyl amine}}{C_2H_5NH_2} + H_2O$

19. Give examples of reactions in which O – H bond in alcohols breaks.

Ans. Reactions in which O – H Bond Breaks

1. $2C_2H_5OH + 2Na \longrightarrow \underset{\text{Sodium ethoxide}}{2C_2H_5ONa^+} + H_2$
2. $C_2H_5OH + CH_3^{\delta-}Mg^{\delta+}I^{\delta-} \longrightarrow CH_4 + Mg\begin{matrix} I \\ OC_2H_5 \end{matrix}$
3. $C_2H_5OH + CH_3COOH \underset{}{\overset{H_2SO_4}{\rightleftharpoons}} \underset{\text{Ethyl acetate}}{CH_3COOC_2H_5} + H_2O$

bnattiAcademy

20. Explain the oxidation of alcohols.

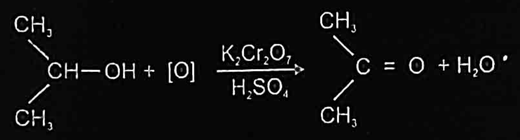
Ans. Oxidation of Alcohols

Oxidation of alcohols convert them into aldehydes and ketones. The best reagent for this purpose is acid dichromate.

Primary Alcohols oxidize to aldehydes.

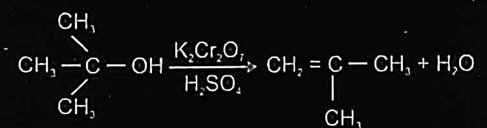
$$CH_3\text{-}CH_2OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} \underset{\text{Ethanal (acetaldehyde)}}{CH_3\text{-}CHO} + H_2O$$

Secondary Alcohols oxidize to ketones.



2-Propanol — Propanone (acetone)

Tertiary Alcohols are resistant to oxidation. In the presence of acid dichromate they undergo elimination reaction to give alkenes.



2-methyl-2-Propanol — 2-Methylpropene

21. Ethanol gives different products with conc. H_2SO_4 under different conditions. Justify. **(Rwp 08)**

Ans. Reactions of Ethanol with conc. H_2SO_4

Ethanol reacts with con. H_2SO_4 and gives different products at different temperatures.

Reactions at 180°C :

$$\underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow[180°C]{\text{conc } H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$$

Reactions at 140°C :

$$2C_2H_5OH \xrightarrow[140°]{\text{Conc } H_2SO_4} \underset{\text{Diethyl ether}}{C_2H_5OC_2H_5} + H_2O$$

22. Write balanced equation for reactions of C_2H_5OH with: (a) PCl_3 (b) PCl_5 **(Rwp 08)(D.G Khan 08)**

Ans. Reactions of C_2H_5OH with

(a) PCl_3:

$$3C_2H_5OH + PCl_3 \longrightarrow 3C_2H_5Cl + H_3PO_3$$

(b) PCl_5:

$$C_2H_5OH + PCl_5 \longrightarrow C_2H_5Cl + POCl_3 + HCl$$

23. How will you distinguish between primary, secondary and tertiary alcohols? **(Sgr 10)**

Ans. Lucas Test:

Primary, secondary and tertiary alcohols are identified and distinguished by reacting them with conc. HCl in anhydrous $ZnCl_2$. This is called as Lucas test. In Lucas test alcohols convert into corresponding alkyl halides.

(i) Primary Alcohols:

Primary alcohol forms an oily layer with $ZnCl_2$/HCl on heating.

$$R\text{—}CH_2\text{—}OH + HCl \xrightarrow[\text{Heat}]{ZnCl_2} R\text{—}CH_2\text{—}Cl + H_2O$$

(Primary alcohol) (Primary alkylchloride)

(ii) Secondary Alcohols:

Secondary alcohols form an oily layer in five to ten minutes.

$$R\text{—}\underset{\displaystyle R}{\underset{|}{CH}}\text{—}OH + HCl \xrightarrow[5\text{-}10\ min]{ZnCl_2} R\text{—}\underset{\displaystyle R}{\underset{|}{CH}}\text{—}Cl + H_2O$$

(Secondary alcohol) (Secondary alkylchloride)

(iii) Tertiary alcohols:

Tertiary alcohols form oily layer immediately.

$$R\text{—}\underset{\displaystyle R}{\overset{\displaystyle R}{\overset{|}{\underset{|}{C}}}}\text{—}OH + HCl \xrightarrow[\text{Immediately}]{ZnCl_2} R\text{—}\underset{\displaystyle R}{\overset{\displaystyle R}{\overset{|}{\underset{|}{C}}}}\text{—}Cl + H_2O$$

(Tertiary alcohol) (Tertiary alkylchloride)

24. Distinguish methanol from ethanol by iodoform test. **(Rwp 08)(LHR 08)**

Ans.

Methanol	Ethanol
Methanol does not give iodoform test $CH_3\text{–}OH + I_2 + NaOH \longrightarrow$ No yellow ppt	Ethanol gives iodoform test In iodoform test, ethanol reacts with iodine in the presence of NaOH and gives yellow coloured crystals of iodoform. $CH_3\text{–}CH_2\text{–}OH + 4I_2 + 6NaOH \longrightarrow CHI_3 + HCOONa + 5NaI + 5H_2O$

25. Write down the uses of methanol and ethanol. **(LHR 11)**
Q. Give a chemical test to distinguish between ethanol and propane. **(D.G Khan 10)**

Ans. Uses of Methanol

Methanol is used

- as a solvent for fats, oils, paints, varnishes.
- as antifreeze in the radiators of automobiles
- for denaturing of alcohol.

Uses of Ethanol

Ethanol is used

- as a solvent, as a drink and as a fuel in some countries.
- in pharmaceutical preparations
- as a preservative for biological specimen

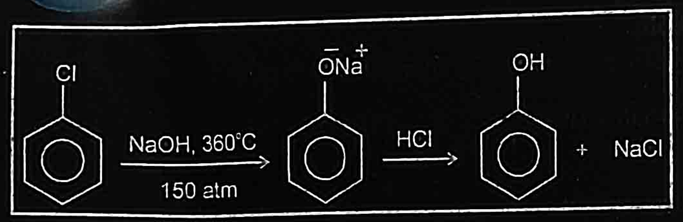
26. Prepare phenol by: (a) Dow's method (b) From sodium salt of Benzenesulphonic acid **(LHR 09)(Grw 11)**

Ans. Preparation of Phenol

1. From Chlorobenzene (Dow's Method):

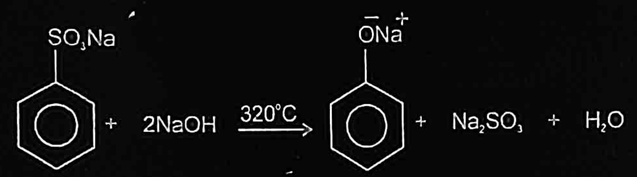
In this method chlorobenzene is treated with 10% NaOH at 360°C and 150 atmospheres pressure. Sodium phenoxide is produced which on treating with HCl gives phenol.

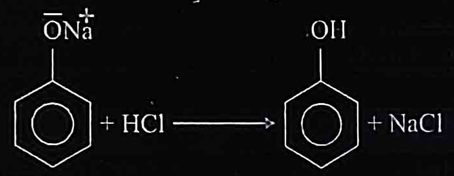
bhatti Academy



2. From Sodium Salt of Benzenesulphonic Acid:

Sodium salt of benzenesulphonic acid reacts with NaOH at 320°C to give sodium phenoxide which on treatment with HCl gives phenol.





The phenol is recovered by steam distillation.

27. Write down uses of phenol. **(LHR 08)**

Ans. Uses of Phenol

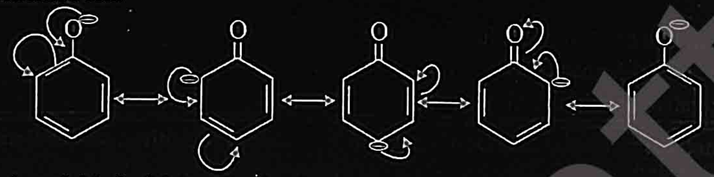
Phenol is used:

- As disinfectant in hospitals and washrooms.
- Its condensation with formaldehyde gives phenolic resins, including bakelite.
- To prepare aspirin and other drugs
- To prepare picric acid, nylon, synthetic detergents, perfume, cosmetics etc.

28. Why phenol is acidic but alcohol is not? **(D.G Khan 10)**

Ans. Phenol as an acid

The acidic nature of phenol is due to phenoxide ion. In phenoxide ion, the negative charge on oxygen atom can become involved with the π – electron cloud on the benzene ring. It gives five **resonance contributing structures** which shows the stability of phenoxide ion.



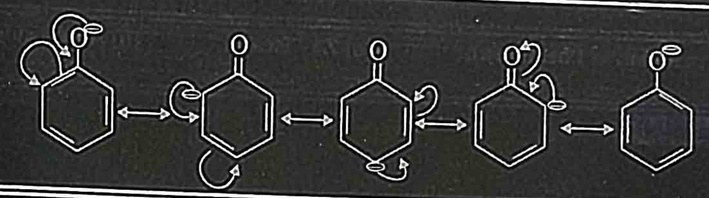
On the other hand, such kind of delocalization is not possible with alcohols.

Moreover, the K_a value of phenol is greater (1.3×10^{-10}) than that of alcohols $(K_a = 10^{-18\rightarrow-16})$.

29. Why phenol is acidic? **(Fsd 09)**

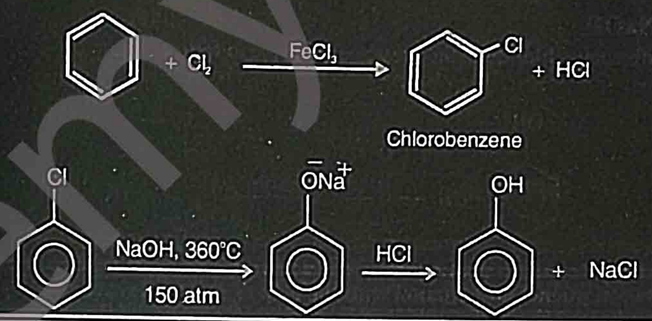
Ans. Acidic Nature of Phenol

The acidic nature of phenol is due to nature of phenoxide ion. The negative charge on oxygen atom can become involved with the π- electron cloud on the benzene ring. The negative charge is thus delocalized in the ring. As a result it gives five resonance contributing structures and the phenoxide ion becomes relatively stable. This type of delocalization is not possible with alcohols.



30. Convert benzene into phenol.

Ans. Conversion of Benzene to Phenol

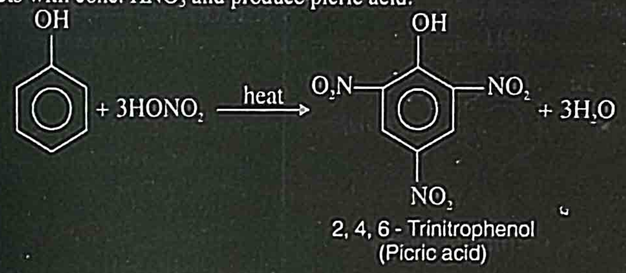


31. Give reactions when phenol reacts with: (i) Conc. HNO_3 (ii) Conc. H_2SO_4 **(Multan 12)**

Ans. Reactions of Phenol with

(i) Conc. HNO_3:

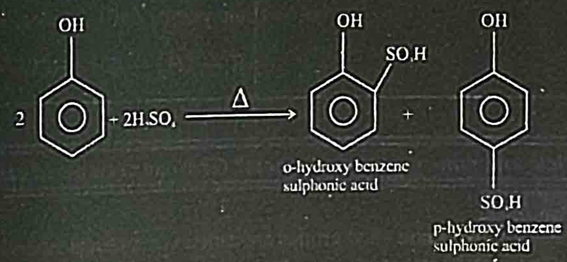
Phenol reacts with conc. HNO_3 and produce picric acid.



2, 4, 6 - Trinitrophenol
(Picric acid)

(ii) Conc. H_2SO_4:

Phenol reacts with conc. H_2SO_4 at room temperature giving ortho and para hydroxy benezenesulphonic acids.



o-hydroxy benzene sulphonic acid

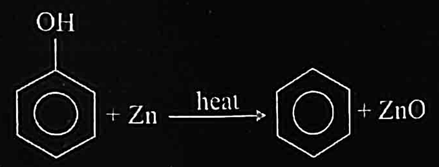
p-hydroxy benzene sulphonic acid

bhatti Academy

32. Write down reactions of Phenol with: (a) Zn / Heat (b) Acetyl chloride / NaOH (Grw 12)

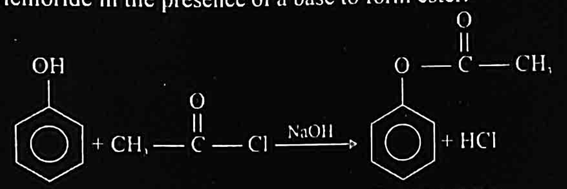
Ans. Reactions of Phenol with

(a) Zn / Heat:



(b) Acetyl chloride / NaOH

Phenol reacts with acetylchloride in the presence of a base to form ester.



Phenyl acetate

33. Distinguish between phenol and ethanol with the help of chemical reactions.

Ans

Phenol	Ethanol
Reactions with Br_2	
An aqueous solution of phenol reacts with bromine water to give white ppt. of 2,4,6-Tribromophenol. 2, 4, 6 - Tribromophenol	Ethanol gives no reaction with bromine water. $C_2H_5OH + Br_2 \longrightarrow$ No reaction
Reaction with Lucas Reagent	
Phenol gives no reaction with Lucas reagent.	An oily layer is formed when ethanol is treated with anhydrous $ZnCl_2$ in conc. HCl (Lucas reagent). $R-CH_2-OH + HCl \xrightarrow[Heat]{ZnCl_2} R-CH_2-Cl + H_2O$

34 What are symmetrical and non-symmetrical ethers? Give one example of each. ((Sgr 10)

Ans. Symmetrical Ethers (R – O – R)

Those ethers which contain two same alkyl groups are called symmetrical ethers.

Examples: Dimethyl ether (CH_3OCH_3), Diethyl ether ($CH_3—CH_2—O—CH_2—CH_3$) etc.

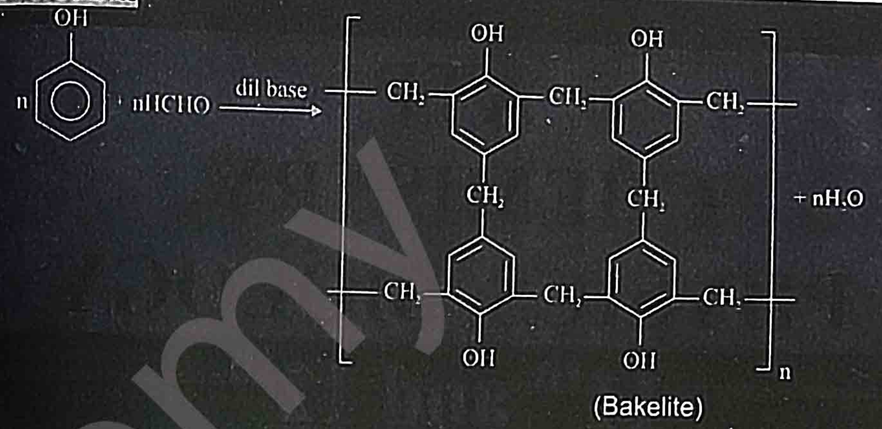
Non-Symmetrical Ethers

Those ethers which contain different alkyl or phenyl groups are called non-symmetrical ethers.

Examples: Ethyl methyl ether ($CH_3—O—CH_2—CH_3$), Methyl phenyl ether ($CH_3OC_6H_5$) etc.

35. How Bakelite is prepared from phenol? (D.G Khan 08)

Ans. Preparation of Bakelite



(Bakelite)

36. Ethanol has higher boiling point than diethyl ether. Why?

Ans. Higher Boiling Point of Ethanol than Diethyl ether

Boiling point of a compound depends upon the strength of intermolecular forces present in it. The intermolecular forces in ethanol are strong hydrogen bonding due to which ethanol has higher boiling point (78.3°C).

On the other hand, diethyl ether has weak London dispersion forces due to which its boiling point is lower (34.6°C) than that of ethanol.

37. How ethers are prepared? (D.G Khan 08)

Ans. Preparation of Ethers

(i) By Williamsons Synthesis:

Alcohols react with metallic sodium to form alkoxides. This alkoxide ion is a strong nucleophile and readily react with alkyl halides to produce an ethers.

$$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5O^-Na^+ + H_2$$

$$C_2H_5O^-Na^+ + C_2H_5Br \longrightarrow C_2H_5OC_2H_5 + NaBr$$

(ii) Reactions of Alkyl halides with dry silver oxide:

$$2C_2H_5Br + Ag_2O \longrightarrow C_2H_5OC_2H_5 + 2AgBr$$

****

bhattiAc

Available in Market

ATP
CHEMISTRY,
PHYSICS, BIOLOGY
11th and 12th

CHAPTER 12

ALDEHYDES AND KETONES

Solved Objective Exercise

Q.1 Fill in the blanks.

(i). Aldehydes are the first oxidation product of_____
(ii). Ketones are the first oxidation product of_____
(iii). Aldehydes and ketones undergo__ addition reactions.
(iv). Formaldehyde reacts with _____ to give primary alcohol.
(v). Acetaldehyde reacts with _____ to give 2-Butanol.
(vi). Aldehydes are strong _____ agents.
(vii). The oxidation of an _____ always gives a carboxylic acid.
(viii). The reduction of a _____always gives a secondary alcohol.
(ix). Formaldehyde gives _____test with Tollen's reagent.
(x). Acetaldehyde gives_____ precipitates with Fehling's solution.

Answer Key.

(i)	Primary Alcohols	(ii)	Secondary Alcohols
(iii)	Nucleophilic	(iv)	Grignard Reagent
(v)	Ethyl magnesium bromide	(vi)	Reducing
(vii)	Aldehyde	(viii)	Ketone
(ix)	Silver Mirror	(x)	Brick red

Q.2 Indicate true or false.

(i). Formaldehyde is used in the silvering of mirrors.
(ii). Ketones combine with alcohols in the presence of HCl gas to form acetals.
(iii). Acetaldehyde undergoes cannizzaro's reaction.
(iv). Formaldehyde is used for silvering of mirrors.
(v). Aldol condensation reaction is given by only those aldehydes and ketones which contain α-hydrogen atom.
(vi). Cannizzaro's reaction is given by only those aldehydes containing no α hydrogen atom.
(vii). Propanal and propanone behave differently with Tollen's reagent.
(viii). Acetone reacts with sodium bisulphite to give a yellow crystalline product.
(ix). Acetone on reduction gives a primary alcohol.
(x). 40%aqueous solutions of formaldehyde is called formalin.

Answer Key.

(i)	True	(ii)	False	(iii)	False	(iv)	True	(v)	True
(vi)	True	(vii)	True	(viii)	False	(ix)	False	(x)	True

bhattiAca

Q.3 Multiple choice questions. Encircle the correct answer.

(i). The carbon atom of a carbonyl group is.
(a) sp hybridized (b) sp^2 hybridized (c) sp^3 hybridized (d) none of these

(ii). Formalin is
(a) 10% solution of formaldehyde in water (b) 20% solution of formaldehyde in water
(c) 40% solution of formaldehyde in water (d) 60% solution of formaldehyde in water

(iii). Which of the following will have the highest boiling poir.?
(a) Methanal (b) Ethanal (c) Propanal (d) 2-Hexanone

(iv). Ketones are prepared by the oxidation of.
(a) Primary alcohol (b) Secondary alcohol (c) Tertiary alcohol (d) None of these

(v). Acetone reacts with HCN to form a cyanohydrin. It is an example of.
(a) Electrophilic addition (b) Electrophilic substitution
(c) Nucleophilic addition (d) Nucleophilic substitution

(vi). Which of the following compounds will not give iodoform test on treatment with I_2 / NaOH
(a) Acetaldehyde (b) Acetone (c) Butanone (d) 3 – Pentanone

(vii). Which of the following compounds will react with Tollen's reagent.

(a) $CH_3-\overset{O}{\overset{\|}{C}}-H$ (b) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

(c) $CH_3-\overset{O}{\overset{\|}{C}}-OH$ (d) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_3$

(viii) Cannizzaro's reaction is not given by.
(a) Formaldehyde (b) Acetaldehyde (c) Benzaldehyde (d) Trimethylacetaldehyde

(ix) Which of the following reagents will react with both aldehydes and ketones?
(a) Grignard reagent (b) Tollen's reagent (c) Fehling's reagent (d) Benedict's reagent

Solved Exercise MCQ's

Q. No	Answer	Reason
(i)	(b) sp^2 hybridized	> C = O, double bond shows sp^2 character of carbonyl group.
(ii)	(c) 40% solution of formaldehyde in water	It is used as an antiseptic, a disinfectant, a germicide, a fungicide etc.
(iii)	(d) 2-Hexanone	2-Hexanone has highest b.p. due to large size.
(iv)	(b) secondary alcohols	$R_2HC-OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} R-\overset{O}{\overset{\|}{C}}-R + H_2O$
(v)	(c) Nucleophilic addition	As reaction starts by attack of nucleophile.
(vi)	(d) 3-Pentanone	In 3 – Pentanone, methyl group ($-CH_3$) is attached with carbonyl carbon, so it gives iodoform test.
(vii)	(a) $CH_3-\overset{O}{\overset{\|}{C}}-H$	Aldehyde form silver mirror with Tollen's reagent.
(viii)	(b) Acetaldehyde	Acetaldehyde (CH_3CHO) have α– hydrogen atom
(ix)	(a) Grignard reagent	Tollen, Fehling and Benedict's reagents do not react with ketones because they are not strong oxidizing agents.

Previous Boards MCQ's

1. Which of the following reactions is used for detecting the presence of carbonyl group? (D.G Khan 2008)
(a) Reaction with hydroxylamine (b) Reaction with hydrazine
(c) reaction with 2, 4 – dinitrophenyl hydrazine (d) All of the above

2. Following is an aromatic aldehyde (D.G Khan 2009)
(a) Butanone (b) 2-pentanone (c) Pentanol (d) Benzaldehyde

3. Which one of the following reacts with Tollen's reagent (D.G Khan 2010)
(a) acetone (b) Pentanone (c) Butanone (d) Ethanal

4. Ketones are always reduced to (Rwp 2008)
(a) Primary alcohols (b) Secondary alcohols (c) Tertiary alcohols (d) None of these

5. Aldol product on heating undergoes (Rwp 2009)
(a) Decomposition (b) Dehydration (c) Rearrangement (d) None of these

6. Acetone is prepared by the hydrolysis of (Rwp 2010)
(a) Ethyne (b) Propyne (c) Ethane (d) Propane

7. Acidified oxidizing agent for the laboratory preparation of Acetaldehyde is (Rwp 2016)
(a) $K_2Cr_2O_7 + H_2O \rightarrow$ (b) $Na_2Cr_2O_7 + H_2SO_4 \rightarrow$
(c) $K_2Cr_2O_7 + H_2S \rightarrow$ (d) $Na_2Cr_2O_7 + NO_2 \rightarrow$

8. Cannizzaro's reaction is not given by (Fsd 09 , Lhr 12, Sgr 09)
(a) Formaldehyde (b) Acetaldehyde (c) Benzaldehyde (d) Trimethylacetaldehyde

9. The carbon atom of carbonyl group is (Fsd 10, Grw 11, Lhr 11)
(a) sp hybridized (b) sp^2 hybridized (c) sp^3 hybridized (d) d sp^2 hybridized

10. The compound which does not give iodoform test (Sgr 2010)
(a) Acetaldehyde (b) Ethyl alcohol (c) Formaldehyde (d) Acetone

11. Which compound will not give iodoform test on treatment with I_2 / NaOH? (Grw 08, Fsd 12)
(a) Acetaldehyde (b) Acetone (c) Butanone (d) 3 – pentanone

12. Ketones are prepared by the oxidation of (Grw 2009)
(a) Primary alcohols (b) Secondary alcohols (c) Tertiary alcohol (d) None of these

13. Acetone reacts with HCN to form cyanohydrin. It is an example of (Lhr 2010)
(a) Electrophilic addition (b) Electrophilic substitution
(c) Uucleophilic addition (d) Nucleophilic substitution

14. Addition of alcohol in carbonyl compounds gives acetal, the geometry of acetal is (Lhr 2011)
(a) Linear (b) Trigonal (c) Tetrahedral (d) Planar

15. Formation of acetaldehyde from ethanol is known as: (Fsd. 2012)
(a) Reduction (b) Addition (c) Oxidation (d) Substitution

16. The compound used in the processing of anti-polio vaccine is: (Lhr. 2012)
(a) Acetaldehyde (b) Formaldehyde (c) Acetone (d) Ethyl bromide

17. Aldehydes and Ketones react with 2, 4 dinitrophenyl hydrazine solution to give precipitate of the colour: (Lhr.2012)
(a) Yellow or red (b) Orange or red (c) White or red (d) Black or red

18. Which of the following reagent will react with both aldehydes and ketones: (Lhr.2012)
(a) Grignard reagent (b) Tollen's reagent (c) Fehling's reagent (d) Benedict's reagent

19. Silver mirror is given by: (Grw.2012)
(a) Aldehydes (b) Ketones (c) Ethers (d) Acids

20. Methyl ketones are characterized by: (Grw.2012)
(a) Tollen's reagent (b) Iodoform test (c) Benedict's reagent (d) Fehling solution

bhattiAcademy

Entry Test MCQ's

1. Which of the following tests is used to distinguish between methyl alcohol and ethyl alcohol
(a) Fehling solution test (b) Br_2/H_2O test (c) Tollen's reagent test (d) Iodoform test
2. The general formula of both aldehydes and ketones is:
(a) $C_nH_{2n-2}O$ (b) $C_nH_{2n-4}O$ (c) $C_nH_{2n-2}O$ (d) $C_nH_{2n}O$
3. Aldehyde group can occur:
(a) Anywhere in the carbon chain (b) In the middle of carbon chain
(c) Only at the second carbon atom of the chain (d) Only at the end carbon atom of the chain
4. The reagent with which both aldehyde and ketone react easily is
(a) Fehling solution (b) Schiff's reagent (c) Grignard reagent (d) Tollens's reagent
5. When acetaldehyde is heated with Fehling's solution, it gives brick red precipitate of :
(a) Cu (b) Cu+Cu_2O (c) CuO (d) Cu_2O
6. Methyl ketones are characterized through
(a) Tollen's reagent (b) Schiff's test (c) Iodoform test (d) Benedict's reagent
7. All of the following aldehydes are in the liquid state except:
(a) Methanal (b) Propanal (c) Ethanal (d) Butanal
8. Which of the following is the most reactive specie
(a) Methanal (b) Propanal (c) Ethanal (d) Acetone
9. Ketones are less reactive than aldehydes because of
(a) Stearic hindrance (b) Both a and c
(c) Two alkyl groups are electron donating (d) None of the above
10. Aldehydes and ketones give which of the following mechanism of reaction
(a) Electrophilic addition reaction (b) Acid-base reaction
(c) Nucleophilic addition reaction (d) Elimination reaction
11. Which of the following reactions is not shown by aldehydes
(a) Cannizzaro's reaction (b) Polymerization
(c) Reaction with alcohol (d) Reaction with sodium nitroprusside
12. Which of the following reagent will not react with Ethanal?
(a) HCl (b) PCl_5 (c) Cl_2 (d) $NaHSO_4$
13. Which of the following statement is incorrect:
(a) A base catalyst increases the nucleophilic character of the reagent
(b) Acid catalyst increases the positive character of the carbonyl carbon atom
(c) Aldehyde having no α- hydrogen give cannizzaro reaction
(d) Formaldehyde on polymerization gives paraldehyde
14. Which of the following tests are shown by both aldehydes and ketones
(a) Reaction with Brady's reagent (2,4 DNPH) in dilute acid (b) Reaction with HCN
(c) Reaction with $NaHSO_3$ (d) All of the above
15. Which of the following is not reducing agent:
(a) Sodium borohydride ($NaBH_4$ in water) (b) Nascent hydrogen 2[H]
(c) Lithium aluminiumhydride ($LiAlH_4$ in dry ether) (d) Carbon dioxide (CO_2)
16. All of the following are uses of formaldehyde except:
(a) Used in making Bakelite plastic (b) In making medicine urotropine
(c) 40% aqueous solution called formalin is used as an antiseptic (d) Used to make chloralhydrate.
17. Aldehyde behave as:
(a) Oxidizing agent (b) Dehydrating agent
(c) Reducing agent (d) Oxidizing as well as reducing agent
18. Acetals are:
(a) Aldehyde (b) Ketones (c) Diethers (d) Hydroxy aldehyde
19. Which is most easily oxidized:
(a) Methanol (b) Propanal (c) Ethanol (d) Benzaldehyde

20. A compound that gives a positive iodo form test is:
(a) 1-Pentanol (b) 3-Pentanone (c) 2-Pentanone (d) Pentanal

Additional MCQ's

1. In formaldehyde oxygen contain lone pair:
(a) Only one (b) Two lone pairs (c) No lone pair (d) Both a and b
2. Which one can react with HCN to form an addition product:
(a) Ethanal (b) Acetamide (c) Ethanoic acid (d) All
3. Formalin contains water in proportion of:
(a) 8% (b) 40% (c) 52% (d) 25%
4. Dimethyl ketones can be prepared by distillation of:
(a) Calcium acetate (b) Ethylene (c) Ethyl alcohol (d) Both b and c
5. 3 – Hydroxybutanal loses water on heating in the presence of dilute acid to form:
(a) Formaldehyde (b) Acetaldehyde (c) Crotonaldehyde (d) Propionaldehyde
6. Haloform test is given by the following aldehyde?
(a) Formaldehyde (b) Acetaldehyde (c) Benzaldehyde (d) All
7. Which of the following are hydrolysed by an aqueous acid to give a hydroxypropanoic acid.
(a) Formaldehyde cyanohydrin (b) Acetaldehyde cyanohydrin
(c) Acetone cyanohydrin (d) None of these
8. Aldehydes can be oxidized to:
(a) Ketones (b) Alkanes (c) Carboxylic acids (d) Both a and c
9. In Cannizzaro's reaction, alcohol is a:
(a) Reduced product (b) oxidized product (c) Aromatic hydrocarbon (d) None of above
10. Paraldehyde is used as:
(a) Poison (b) Dye (c) Polymer (d) Hypnotic drug
11. In Cannizarro's reaction methoxide ion acts as:
(a) Base (b) Acid (c) Reducing agent (d) None
12. Precipitates of Sodium Bisulphite are of _____ colour:
(a) Yellow (b) White (c) Brick red (d) Wine red
13. In Cannizzaro's reaction, catalyst used is:
(a) H_2O (b) 50% NaOH (c) Grignard reagent (d) Acid
14. Ketones in which both alkyl groups are larger than methyl, do not react with:
(a) Hydrogen cyanide (b) Grignard reagent (c) Sodium bisulphite (d) Both a and c
15. Sodium Bisulphite test is not given by
(a) Acetone (b) Acetaldehyde (c) 3-pentanone (d) Formaldehyde
16. Acetaldehyde cyanohydrin on acid hydrolysis yields:
(a) Tartaric acid (b) Lactic acid (c) Acetic acid (d) Aspartic acid
17. Bisulphite addition product on heating with HCl forms:
(a) Aldehydes (b) Ketones (c) Alcohol (d) Both a and b
18. In order to distinguish acetaldeyde from other aldehydes, we use:
(a) Iodoform test (b) Lucas test (c) Silver mirror test (d) 2, 4 – DNPH test
19. Aldehydes react with alcohols in the presence of hydrogen chloride gas to form:
(a) Alkynes (b) Carboxylic acid (c) Acetals (d) Haloforms
20. The colour of iodoform is:
(a) Brick red (b) Blue green (c) Reddish brown (d) Yellow
21. Trimer of formaldehyde is
(a) Acetal (b) Metaformaldehyde (c) Paraldehyde (d) None
22. Catalyst used for acetal formation must be:
(a) Moist (b) Dry (c) Strong oxidizing power (d) Reducing agent
23. With hydroxylamine, ethanal forms:

bhattiAc

(a) Ethanaloxime (b) Ethanal hydrazone (c) Diethyl ether (d) 2, 4 – DNPH

24. **Ethanal reacts with phenylhydrazine in the presence of:**
(a) Na^+ (b) OH^- (c) Cl^- (d) None

25. **The hydrogen atom attached to the carbonyl group in aldeydes is oxidized to:**
(a) Hydroxyl group (b) Formyl group (c) Amino group (d) Ester group

26. **Acetal reacts with water to give:**
(a) Alcohol (b) Aldehyde (c) Ketone (d) Both a and b

27. **Aldehydes are reduced to:**
(a) Ketones (b) Secondary alcohols (c) Both b and d (d) Primary alcohols

28. **Carbonyl group can be reduced in the presence of**
(a) Pd (b) Ni (c) $NaBH_4$ (d) All of these

29. **Ketones are reduced to:**
(a) Secondary alcohols (b) Acetals (c) Acetaldehydes (d) None of these

30. **Oxidatoin of ketones resists in the presence of**
(a) $K_2Cr_2O_7 / H_2SO_4$ (b) $KMnO_4 / H_2SO_4$ (c) $AgNO_3 / NH_4OH$ (d) HNO_3 conc.

31. **In the presence of $AgNO_3 / NH_4OH$ acetone give ppt:**
(a) Blue (b) Reddish brown (c) Yellow (d) None

32. **Fehling's solution is chemically**
(a) Neutral (b) Acidic (c) Basic (d) None

33. **With Benedict's solution, aldehydes give**
(a) Brick red ppt (b) Blue ppt (c) Blue green (d) None

34. **Rubber-accelerator is chemically**
(a) Formaldehyde ammonia (b) Formaldehyde trimer
(c) Acetaldehyde ammonia (d) Acetaldehyde trimer

35. **Which can be used as antiseptic**
(a) Formalin (b) Formaldehyde (c) Acetaldehyde (d) All

36. **Benedict's solution is an alkaline solution of**
(a) Cupric citrate (b) Cupric tartarate (c) Silver citrate (d) Silver tartarate

37. **Oxidation of Butanone gives**
(a) Formic acid (b) Acetic acid (c) Propanoic acid (d) Both a and b

38. **Acetaldehyde on oxidation by strong oxidizing agents gives:**
(a) Methanol (b) Acetic acid (c) Acetone (d) None of these

39. **In the reduction of aldehydes and ketones with sodium borohyrides, the hydride ion acts as a:**
(a) Electrophile (b) Catalyst (c) Nucleophile (d) None of these

40. **Cannizzaro's reaction is not carried out by:**
(a) Methanal (b) Benzaldehyde (c) 2,2- Dimethyl Propanal (d) Ethanal

ANSWERS TO MCQ'S

Previous Boards MCQ's

Q. No	Answer	Reason
1.	(c) Reaction with 2, 4-DNPH	Carbonyl compounds give yellow or red ppt. with 2, 4- DNPH
2.	(d) Benzaldehyde	Since it contains benzene in its structure.
3.	(d) Ethanal	Ethanal (aldehyde) gives positive test with Tollen's reagent.
4.	(b) Sec. Alcohol	$R-\overset{\overset{O}{\|\|}}{C}-R + H_2 \xrightarrow{Ni, Pt, Pd} R-\underset{R}{\overset{H}{\overset{\|}{C}}}-OH$

5.	(b) dehydration	$CH_3-\underset{OH}{CH}-CH_2-\overset{O}{\overset{\|}{C}}-H \xrightarrow[\Delta]{dil.\ HCl} CH_3-CH=CH-\overset{O}{\overset{\|}{C}}-H + H_2O$ (3-Hydroxybutanal → Crotonaldehyde)
6.	(b) Propyne	$H_3C-C\equiv CH + H_2O \xrightarrow[H_2SO_4]{HgSO_4} H_3C-\overset{O-H}{\overset{\|}{C}}=CH_2 \rightleftharpoons H_3C-\overset{O}{\overset{\|}{C}}-CH_3$ (Acetone (Ketone))
7.	(b) $Na_2Cr_2O_7 + H_2SO_4$	This catalyst helps to oxidize alcohol to CH_3CHO
8.	(b) Acetaldehyde	Acetaldehyde has α – Hydrogen atom.
9.	(b) sp^2 hybridized	C is jointed with three atoms showing its sp^2 nature.
10.	(c) formaldehyde	Absence of $-CH_3$ group. Formaldehyde (HCHO)
11.	(d) 3-Pentanone	No methyl group is connected with carbonyl carbon. ($C_2H_5 – CO – CH_2H_5$)
12.	(b) Secondary Alcohol	$\begin{matrix}R\\ \diagdown\\ HC-OH\\ \diagup\\ R\end{matrix} + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} \begin{matrix}O\\ \|\|\\ R-C-R\end{matrix} + H_2O$
13.	(c) nucleophilic addition	The reaction is initiated by attack of nucleophile.
14.	(c) tetrahedral	Since C – atom is sp^3 – hybridized, so it has tetrahedral structure.
15.	(c) Oxidation	$CH_3CH_2OH + [O] \xrightarrow[\Delta]{Na_2Cr_2O_7 + H_2SO_4} CH_3CHO + H_2O$
16.	(b) Formaldehyde	Formaldehyde is HCHO (methanal).
17.	(a) Yellow or red	This reaction is used for identification of carbonyl compounds.
18.	(a) Grignard reagent	Other three reagents can only react with aldehydes.
19.	(a) Aldehydes	Aldehydes react with Tollen's reagent to form silver mirror.
20.	(b) Idoform test	They give idoform test due to – CH_3 group.

Entry Test MCQ's

Q. No	Answer	Reason
1.	(d) Iodoform test	Ethylalcohol gives iodoform test while methylalcohol don't.
2.	(d) $C_nH_{2n}O$	CH_2O (Formaldehyde), ($CH_3CHO = C_2H_4O$, Acetaldehyde etc.
3.	(d) Only at the end C-atom of chain	In aldehydes, the carbonyl group is bonded to at least one hydrogen atom, and so it occurs at the end of a chain.
4.	(c) Grignard reagent	Aldehydes & Ketones react with Grignard reagent to form alcohols.
5.	(d) Cu_2O	This test is used to distinguish aliphatic aldehydes from aromatic aldehydes and ketones.
6.	(c) Iodoform test	Iodoform test is given due to presence of methyl group.
7.	(a) Methanal	Methanal exists in the gaseous state.
8.	(a) Methanal	Methanal is highly reactive due to small size and absence of alkyl group.
9.	(b) both a and c	In aldehydes stearic hindrance is less and C – H bond is polar slighty
10.	(c) Nucleophilic addition reaction	In most of the reactions of carbonyl compounds, the nucleophilic reagent can start the initial attack on the carbon. After that electrophile attacks. So reactions are called Nucleophilic addition reactions.
11.	(d) reaction with sodium nitroprusside	Ketones give wine red or orange red colour with sodium nitroprusside.

bnuTAcademy

12.	(b) PCl_5	Ethanal shows no reaction with PCl_5.
13.	(d) formaldehyde on polymerization gives paraldehyde	Formaldehyde gives metaformaldehyde on polymerization.
14.	(d) All of the above	These reactions are used to identify carbonyl compounds.
15.	(d) Carbondioxide (CO_2)	CO_2 does not discharge hydrogen to any other substance.
16.	(d) Used to make chloral hydrates	Acetaldehyde makes chloral hydrates.
17.	(c) Reducing agent	They are easily oxidized even by weak oxidizing agents.
18.	(c) Diethers	As acetals contain two alkoxy groups.
19.	(b) Propanal	It is easily oxidized due to – C – H group & small size.
20.	(c) 2 – Pentanone	$CH_3-CH-CH_2-\overset{O}{\overset{\|\|}{C}}-CH_3$ Because methyl group ($-CH_3$) is attached with carbonyl carbon.

Additional MCQ's

Q. No.	Answer	Reason
1.	(b) Two lone pairs	Oxygen carries partial –ive charge due to presence of two lone pairs.
2.	(a) Ethanal	The product of the reaction is cyanohydrin
3.	(b) 52%	It is used as an antiseptic, a disinfectant, a germicide, a fungicide & for sterilizing animal specimens.
4.	(a) Calcium acetate	$(CH_3COO)_2Ca \xrightarrow{\Delta} CH_3-CO-CH_3 + CaCO_3$ Acetone
5.	(c) Crotonaldehyde	$CH_3-\underset{OH}{CH}-\underset{\beta}{CH_2}-\underset{\alpha}{\overset{O}{\overset{\|}{C}}}-H \xrightarrow[\Delta]{\text{dil. HCl}} CH_3-CH=CH-\overset{O}{\overset{\|\|}{C}}-H + H_2O$ 3-Hydroxybutanal → Crotonaldehyde
6.	(b) Acetaldehyde	It contains $-CH_3$ group attached to carbonyl carnbon.
7.	(b) Acetaldehyde cyanohydrin	$CH_3-\underset{OH}{CH}-CN + 2H_2O + H_2SO_4 \longrightarrow CH_3-\underset{OH}{CH}-COOH + NH_4HSO_4$ Acetaldehyde cyanohydrin → 2-Hydroxypropanoic acid (Lactic acid)
8.	(c) Carboxylic acids	$CH_3-\overset{O}{\overset{\|\|}{C}}-H + [O] \xrightarrow{K_2Cr_2O_7+H_2SO_4} CH_3-\overset{O}{\overset{\|\|}{C}}-OH$ Acetaldehyde → Acetic acid
9.	(a) Reduced product	Alcohol is formed by addition of two H-atoms to aldehydes.
10.	(d) Hypnotic drug	Paraldehyde is a polymer of ethanal.
11.	(a) Base	As methoxide ion accepts proton from formic acid.
12.	(b) White	This reaction is used for the separation of carbonyl compounds.
13.	(b) 50% NaOH	It is used as reactant as well as catalyst.
14.	(c) Sodium bisulphite	Only small methyl ketones react with sodium bisulphite
15.	(c) 3-Pentanone	As alkyl groups attached with carbonyl carbon are greater than methyl groups.
16.	(b) Lactic acid	Lactic acid is 3-Hydroxypropanoic acid.
17.	(d) Both a and b	That's why $NaHSO_3$ is used for isolation of carbonyl compounds.

18.	(a) Iodoform test	Due to methyl group, only acetaldehyde gives iodoform test.
19.	(c) Acetals	Acetals have tetrahedral geometry.
20.	(d) Yellow	Iodoform is used to distinguish between [illegible] ketones & others.
21.	(b) Metaformaldehyde	It is also called methanol trimer.
22.	(b) Dry	Under moisture, the other reactions may occur.
23.	(a) Ethanaloxime	$CH_3-CH=O + H_2NOH \xrightarrow{H^+} CH_3-CH=N-OH + H_2O$ Ethanal → Ethanaloxime
24.	(d) None	The reaction occurs in the presence of H^+.
25.	(a) Hydroxyl group	$CH_3-\overset{O}{\overset{\|\|}{C}}-H + [O] \xrightarrow{K_2Cr_2O_7+H_2SO_4} CH_3-\overset{O}{\overset{\|\|}{C}}-OH$ Acetaldehyde → Acetic acid
26.	(d) Both a and b	$(HCOCH_3)_2 + H_2O \xrightarrow{H^+} 2CH_3-CH=O + 2C_2H_5OH$
27.	(d) Primary alcohols	$CH_3-\underset{H}{C}=O + 2[H] \xrightarrow[H_2O]{NaBH_4} CH_3-CH_2-OH$ Ethanal → Ethanol
28.	(d) All of these	$CH_3-\underset{H}{C}=O + 2[H] \xrightarrow[H_2O]{NaBH_4} CH_3-CH_2-OH$ Ethanal → Ethanol $H-\overset{O}{\overset{\|\|}{C}}-H + H_2 \xrightarrow{Pd\text{-}BaSO_4} CH_3OH$ Formaldehyde → Methyl alcohol
29.	(a) Secondary alcohols	$CH_3-\underset{H}{C}=O + 2[H] \xrightarrow[H_2O]{NaBH_4} CH_3-\underset{OH}{CH}-CH_3$ Propanone → 2-Propanol
30.	(c) $AgNO_3$ / NH_4OH	Because $AgNO_3$ / NH_4OH is a mild oxidizing agent.
31.	(d) None	Acetone is a ketone and does not react with $AgNO_3$ / NH_4OH
32.	(c) Basic	It is alkaline solution of cupric tartrate complex ion.
33.	(a) Brick red ppt.	Brick red ppt. are of Cu_2O.
34.	(c) Acetaldehyde ammonia	It is made by acetaldehyde.
35.	(a) Formalin	Formalin is 40% solution of formaldehyde.
36.	(a) Cupric citrate	It is used to distinguish aldehydes from ketones.
37.	(b) Acetic acid	$CH_3-\overset{O}{\overset{\|\|}{C}}-CH_2-CH_3 + 3[O] \xrightarrow{K_2Cr_2O_7+H_2SO_4} CH_3-\overset{O}{\overset{\|\|}{C}}-OH + CH_3-\overset{O}{\overset{\|\|}{C}}-OH$ Butanone → Acetic acid
38.	(b) Acetic acid	$CH_3-\overset{O}{\overset{\|\|}{C}}-H + [O] \xrightarrow{K_2Cr_2O_7+H_2SO_4} CH_3-\overset{O}{\overset{\|\|}{C}}-OH$ Acetaldehyde → Acetic acid
39.	(c) Nucleophile	H^- ion attacks on the electrophilic carbon of carbonyl group to give an alkoxide ion.
40.	(d) Ethanal	Because it has α – Hydrogen atom.

Bhatti Academy

Short Answers Questions

1. How formaldehyde is prepared in laboratory? (Fsd 10)

Ans. Laboratory Preparation of HCHO

Formaldehyde is prepared in the laboratory by passing a mixture of methyl alcohol vapours and air over platinized asbestos or copper or silver catalyst at 300°C.

$$2CH_3OH + O_2 \xrightarrow[300^\circ C]{\text{Pt-asbestos}} 2H-\overset{\overset{O}{\|}}{C}-H + 2H_2O$$

2. Give industrial method with all the conditions to prepare formaldehyde.

Ans. Industrial Preparation of Formaldehyde

Formaldehyde is manufactured by passing a mixture of methanol vapours and air over iron oxide molybdenum oxide or silver catalyst at 500 °C.

$$2CH_3OH + O_2 \xrightarrow[500^\circ C]{FeO,MoO_3} 2H-\overset{\overset{O}{\|}}{C}-H + 2H_2O$$

3. Write methods to prepare formaldehyde and acetaldehyde. (Fsd 12)

Ans. Preparation of Formaldehyde

Formaldehyde is manufactured by passing a mixture of methanol vapours and air over iron oxide molybdenum oxide or silver catalyst at 500 °C.

$$2CH_3OH + O_2 \xrightarrow[500^\circ C]{FeO,MoO_3} 2H-\overset{\overset{O}{\|}}{C}-H + 2H_2O$$

Preparation of Acetaldehyde

Acetaldehyde is prepared industrially by air oxidation of ethylene using palladium chloride catalyst with a cupric chloride promoter.

$$\underset{\text{Ethylene}}{2CH_2=CH_2} + O_2 \xrightarrow[H_2O]{PdCl_2+CuCl_2} \underset{\text{Acetaldehyde}}{2CH_3-\overset{\overset{O}{\|}}{C}-H}$$

4. Write a method for large scale preparation of acetone.

Ans. Preparation of Acetone

Acetone is prepared by dry distillation of calcium acetate

$$\begin{matrix}CH_3COO\\ \\ CH_3COO\end{matrix}\!\!>\!Ca \xrightarrow{\text{Heat}} \underset{\text{Acetone}}{CH_3-CO-CH_3} + CaCO_3$$

5. What type of polarity is present in carbonyl group?

Ans. Polarity in Carbonyl Group

The carbonyl group has a σ – bond and a π – bond . The carbon of carbonyl group is sp^2-hybridized. As oxygen is more electronegative, it tends to attract the π – electrons towards itself. This attraction makes the carbonyl group a **polar group.** The oxygen atom has a partial negative charge on it and is **nucleophilic**, whereas the carbon atom has a partial positive charge and is **electrophilic**.

$$\overset{\delta+}{C}=\overset{\delta-}{O}$$

6. How acids and bases (acting as catalysts) increase the reactivity of aldehydes and ketones?

Ans. Base ---- As a Catalyst

During the nucleophilic addition reactions of carbonyl compounds, a base acts as a catalyst when the reagent is comparatively strong nucleophile. Base catalyst increases the nucleohilic character of adding reagent and makes it suitable for electrophilic attack.

Acid ---- As a Catalyst

An acid is used as a catalyst when the adding reagent is weak nucleophile. An acid catalyst increases the electrophilic character of carbonyl carbon and makes it suitable for nucleophilic attack.

7. Write general mechanism for Base catalyzed addition reactions of carbonyl compounds. (Sgr 10)

Ans. General Mechanism for Base-Catalysed Addition Reactions

(i) To Generate Nucleophile:

$$H-O^- + H-Nu \rightleftharpoons Nu^- + HOH$$

(ii) Attack of Nucleophile:

$$Nu^- + \overset{\delta+}{C}=\overset{\delta-}{O} \rightleftharpoons Nu-\underset{|}{C}-O^-$$

(iii) Protonation:

$$Nu-\underset{|}{C}-O^- + \overset{\delta+}{H}-\overset{\delta}{O}H \rightleftharpoons Nu-\underset{|}{C}-OH + \bar{O}H$$

8. Give mechanism of addition of HCN with acetone. (Grw 09)

Ans. Mechanism of addition of HCN to Acetone

The reaction is base-catalysed because HCN has no lone pair or electrons on its carbon. The base (OH^-) generates cyanide ions which act as nucleophiles. The mechanism of the reaction is as follows:

(i) To Generate Nucleophile:

$$H-O^- + H-CN \rightleftharpoons CN^- + H_2O$$

(ii) Attack of Nucleophile:

$$\overset{\delta+}{C}=\overset{\delta-}{O} + :CN^- \rightleftharpoons \overset{O^-}{\underset{CN}{C}}$$

(iii) Protonation:

$$\overset{O^-}{\underset{CN}{C}} + H-OH \rightleftharpoons \overset{OH}{\underset{CN}{C}} + OH^-$$

Addition product

9. Convert acetaldehyde into lactic acid. (Grw 10)

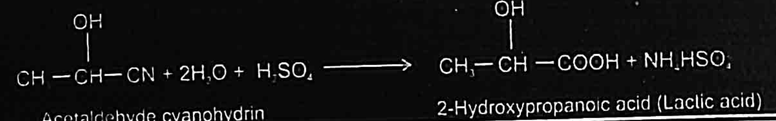
Ans. Acetaldehyde ---- Lactic Acid

(i)

$$\underset{\text{Acetaldehyde}}{\overset{CH_3}{\underset{H}{C}}=O} + HCN \xrightarrow{NaCN/HCl} \underset{\text{Acetaldehyde cyanohydrin}}{\overset{CH_3}{\underset{H}{\overset{OH}{\underset{CN}{C}}}}}$$

(ii) The cyano group, $-C\equiv N$ is hydrolysed by an aqueous acid into a carboxylic acid through an acid amide.

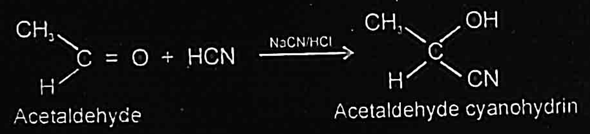
Bhatti Academy



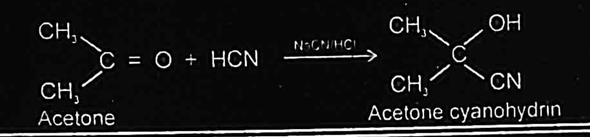
10. Give reactions of HCN with: (a) Acetaldehyde (b) Acetone (D.G Khan 10)

Ans. Reaction of HCN with

(a) Acetaldehyde:



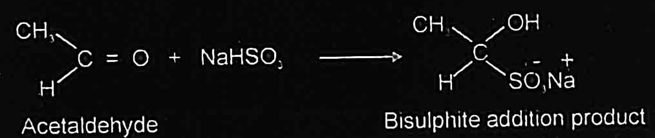
(b) Acetone:



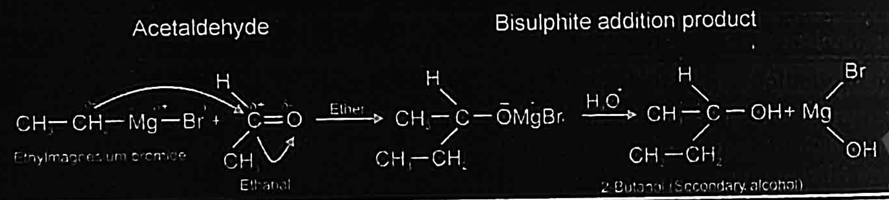
11. Write equations for the reactions of acetaldehyde with: (LHR 12)
(a) $NaHSO_3$ (b) C_2H_5MgBr

Ans. Reaction of CH_3CHO with

(a) $NaHSO_3$:



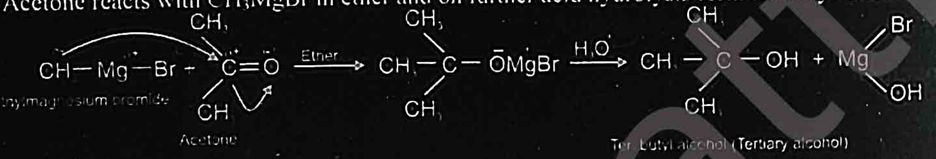
(b) C_2H_5MgBr:



12. How will you convert: (Rwp 07)
(a) Acetone into ter-butyl alcohol (b) Ethanal into 2-Propanol?

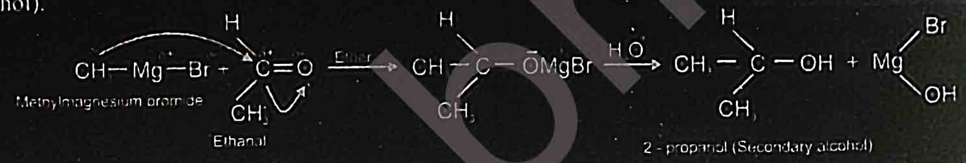
Ans. Conversion of Acetone into Ter-butyl alcohol

Acetone reacts with CH_3MgBr in ether and on further acid hydrolysis form ter-butyl alcohol.



Conversion of Ethanal into 2-propanol

Ethanal (Acetaldehyde) reacts with CH_3MgBr in ether and on further acid hydrolysis form 2-Propanol (secondary alcohol).



bhattiAca

13. How does formaldehyde react with: (a) $NaHSO_3$ (b) conc. NaOH (FSD 08)

Ans. Reactions of Formaldehyde with

(a) $NaHSO_3$:

Formaldehyde reacts with a saturated aqueous solution of sodium bisulphite to form a crystalline white precipitate of sodium bisulphite adduct.



(b) conc. NaOH:

Formaldehyde reacts with conc. NaOH to form methanol (reduced product) and acid in salt form (oxidation product). It is disproportionation reaction.



14. Write mechanism for the addition of sodium bisulphite to an aldehyde. (Grw 12)

Ans. Mechanism for Addition of $NaHSO_3$:

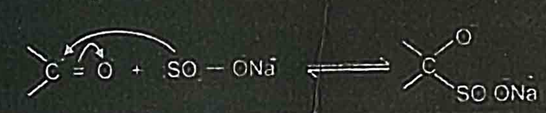
(i) To Generate Nucleophile:

Sodium bisulphite ionizes to form sulphite ions.



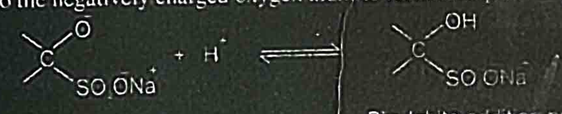
(ii) Attack of Nucleophile:

The sulphite ion acts as a nucleophile, since the sulphur atom is more nucleophilic than oxygen, a C—S bond is formed.



(iii) Protonation:

Proton is attached to the negatively charged oxygen atom to form bisulphite addition product.



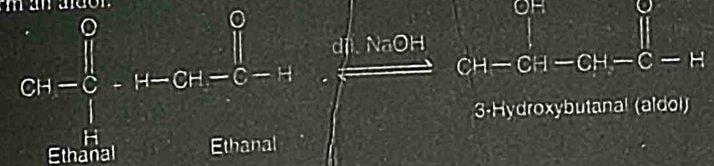
15. What is condensation reaction? Give an example.

Ans. Condensation Reaction

"The reactions in which two molecules of the same or different compounds combine to form a new compound with or without the elimination of a small molecule like H_2O or NH_3, are called condensation reactions."

Example:

Aldol condensation is a condensation reaction. In this reaction, two molecules of the same carbonyl compound condense to form an aldol.

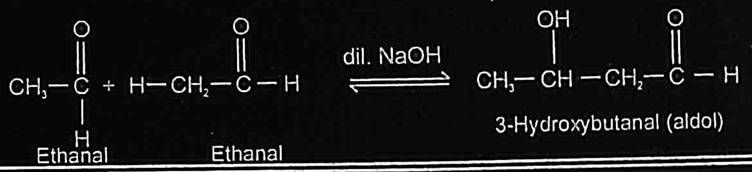


16. What is Aldol condensation? Give one example. **(FSD 08)**

Ans. Aldol Condensation

"Aldehydes and ketones possessing α – hydrogen atoms react with a cold dilute solution of an alkali (10%) to form addition products known as aldols, and this condensation reaction is known as aldol condensation.

Example:



17. Why formaldehyde does not give Aldol condensation reaction? **(Sgr 09)**

Ans. Formaldehyde — Aldol Condensation

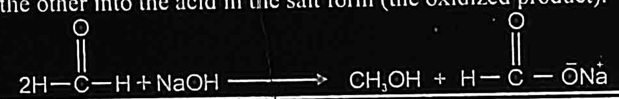
The necessary and sufficient conditions for an aldehyde or a ketone to give aldol condensation is to have α – hydrogen atom in their structures. Formaldehyde (HCHO) does not have α – hydrogen (even it has no α – carbon). Due to which it does not give aldol condensation.

Formaldehyde undergoes Cannizzaro's reaction and produce methanol and sodium formate.

18. How Cannizzaro's reaction is called self-oxidation and reduction reaction? **(D.G Khan 08) (LHR 09)**

Ans. Cannizzaro's Reaction

During self-oxidation and reduction reaction, molecules of a compound are oxidized as well as reduced simultaneously. Cannizzaro's reaction is a disproportionation reaction i.e., self-oxidation reduction reaction. Two molecules of the aldehyde are involved, one molecule being converted into the corresponding alcohol (the reduced product) and the other into the acid in the salt form (the oxidized product).

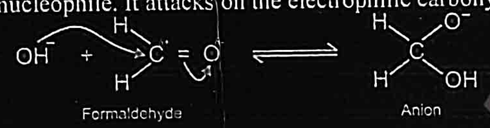


19. Write down the mechanism of Cannizzaro's reaction. **(Grw 10)**

Ans. Mechanism of Cannizzaro's Reaction

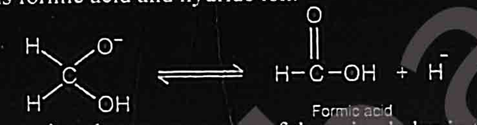
(i) Attack of Nucleophile:

The hydroxide ion acts as a nucleophile. It attacks on the electrophilic carbonyl carbon to form a complex anion.



(ii) Formation of hydride ion:

The anion is unstable. It forms formic acid and hydride ion.



The presence of the negative charge on oxygen of the anion helps in the loss of hydride ion.

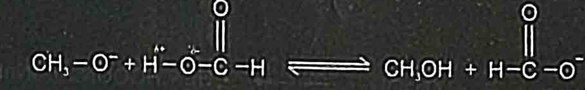
(iii) Attack of Hydride ion:

The hydride ion attacks on the electrophilic carbon of the other molecule to form methoxide ion.



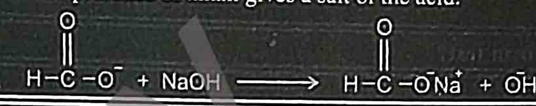
(iv) Transfer of Proton:

The methoxide ion acts as a base and abstracts a proton from formic acid to form methanol and formate ion.



(v) Salt Formation:

The formate ion in the presence of alkali gives a salt of the acid.



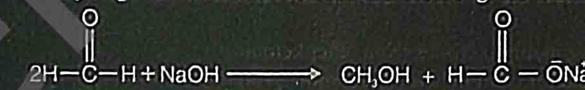
20. What types of aldehydes give Cannizzaro's reaction? **(Rwp 08)**

Ans. Aldehydes giving Cannizzaro's Reaction

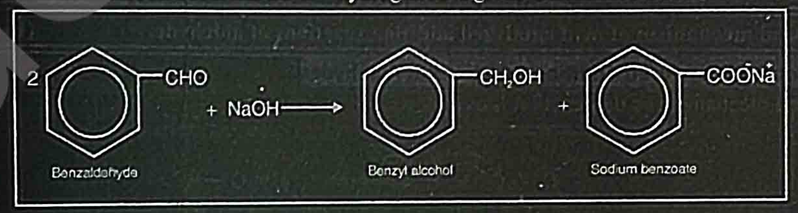
The necessary condition for an aldehyde to give Cannizzaro's reaction is that it must not possess α – hydrogen atom.

Examples:

(i) Formaldehyde do not have α – hydrogen atom even α – carbon therefore it gives Cannizzaro's reaction



(ii) Benzaldehyde has an α – carbon but it has no α – hydrogen so it gives Cannizzaro's reaction.



21. What is a haloform reaction? Give an example. **(LHR 08)**

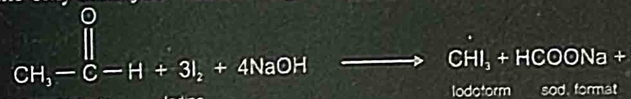
Ans. Haloform Reaction

"Acetaldehydes and methyl ketones react with halogens in the presence of sodium hydroxide to give haloform and sodium salt of the acid. This reaction is called haloform reaction."

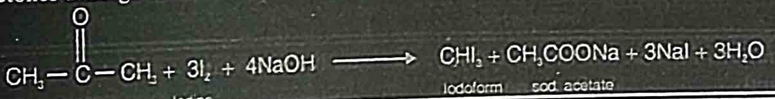
The term haloform is used for the reaction because a haloform (chloroform, bromoform or iodoform) is one of the products.

Examples:

(i) Acetaldehyde is the only aldehyde which undergoes iodoform reaction.



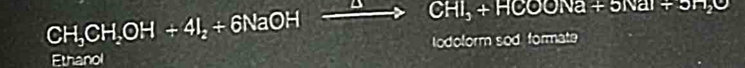
(ii) All secondary ketones undergo iodoform reaction.



22. How iodoform is prepared from ethanol and acetaldehyde? **(LHR 10)**

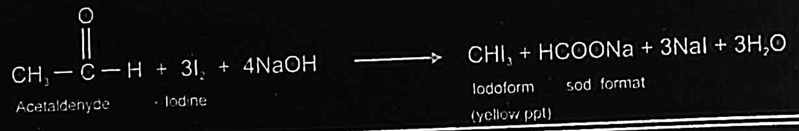
Ans. Preparation of iodoform from:

(i) Ethanol:



bhattiAcademy

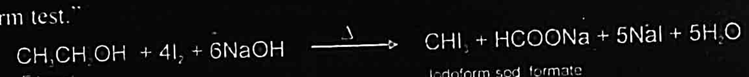
(ii) Acetaldehyde:



23. What is the use of iodoform test? (LHR 09)

Ans. Iodoform Test:

"The haloform reaction using iodine and aqueous sodium hydroxide is called the iodoform test."



It results in the formation of water insoluble iodoform which are bright yellow crystals.

Uses of Iodoform Test:

(i) From a synthetic point of view the haloform reaction affords a convenient method for converting a methyl ketone to a carboxylic acid

(ii) It is used for distinguishing methyl ketones from other ketones.

(iii) It is used to distinguish ethanol from methanol and other primary alcohols.

(iv) It can be used to distinguish acetaldehyde from other aldehydes.

24. Give general mechanism of acid catalyzed addition reactions of aldehyde. (Fsd 10)(Grw 11)

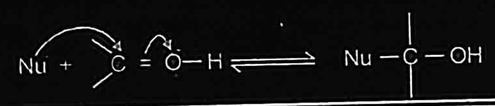
Ans. Mechanism of Acid Catalyzed Addition Reactions of Aldehydes

The general mechanism of the reaction is as follows.

(i) Protonation:



(ii) Attack of Nucleophile:



25. Show equations how formaldehyde and acetaldehyde polymerize in the presence of dil. H_2SO_4. (Grw 09)

Ans. Polymerization of Formaldehyde and Acetaldehyde

Both formaldehyde and acetaldehyde polymerize in the presence of dil. H_2SO_4 to give metaformaldehyde and paraldehyde respectively.

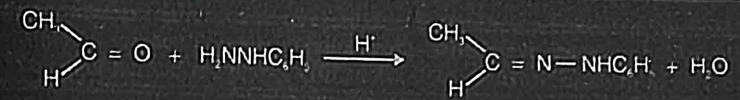


26. Give equations for reaction of Phenylhydrazine with the following: (Grw 08)
(a) Ethanal (b) Propanone

Ans. Reaction of Phenylhydrazine with

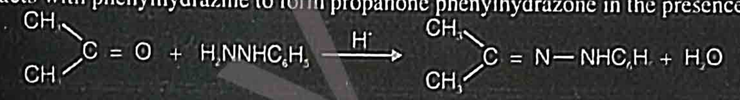
(a) Ethanal:

Ethanal reacts with phenylhydrazine to form ethanal phenylhydrazone in the presence of an acid.



(b) Propanone:

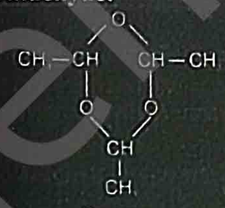
Propanone reacts with phenylhydrazine to form propanone phenylhydrazone in the presence of an acid.



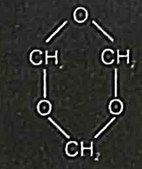
27. Write formula of paraldehyde and metaformaldehyde. (Mtn 12)

Ans. Formulas of

(i) Paraldehyde:

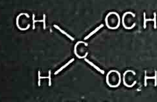


(ii) Metaformaldehyde:



28. Write down the formula and IUPAC name of an ACETAL.

Ans. ACETAL

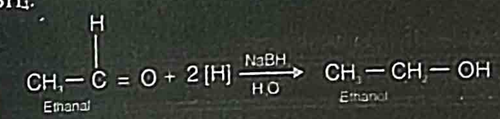


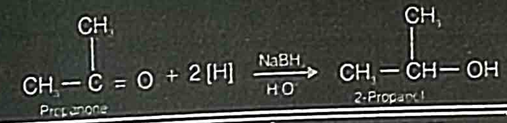
1, 1 – Diethoxy ethane (an acetal)

29. What products are obtained by the reduction of acetaldehyde and acetone with $NaBH_4$?
OR How will you convert ethanal into ethanol, give equation? (Fsd 09)

Ans. Reduction Reactions with $NaBH_4$

Acetaldehyde (Ethanal) and acetone are reduced to primary alcohol and secondary alcohol respectively with sodium borohydride. $NaBH_4$.

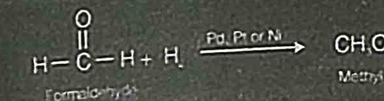




30. Apply your knowledge to convert formaldehyde into methyl alcohol? (Grw 11)

Ans. Formaldehyde — Methyl Alcohol

Formaldehyde on reduction with hydrogen in the presence of a metal catalyst like Pd, Pt, or Ni form methyl alcohol.



bhattiAcademy

31. Name two mild oxidizing agents, which distinguish aldehydes and ketones. (Fsd 10)
OR Which are those weak oxidizing agents which can oxidize aldehydes but not ketones? (Rwp 09)

Ans. Mild Oxidizing Agents

(i) Tollen's Reagent (Ammonical silver nitrate solution)
(ii) Fehling's solution (An alkaline solution containing a cupric tartrate complex ion)
(iii) Benedict's solution (An alkaline solution containing a cupric citrate complex ion)

These mild oxidizing agents can oxidized aldehydes but not ketones. So, they are used to distinguish between aldehydes and ketones.

32. What is silver mirror test? Write a corresponding equation for CH_3CHO. (Fsd 10)
Q Give chemical changes in two steps that occur by the addition of Tollen's reagent to an aldehyde in a test tube and heated. (Grw 11)
Q Discuss the chemistry of Tollen's test.
Q Why Tollen's test is also called silver mirror test?

Ans. Tollen's Test (Silver Mirror Test)

Tollen's test is also called silver mirror test because aldehydes form silver mirror with Tollen's reagent (ammonical silver nitrate solution).

Add Tollen's reagent to an aldehyde solution in a test tube and warm. A silver mirror is formed on the inside of the test tube.

$$AgNO_3 + 3NH_4OH \longrightarrow [Ag(NH_3)_2]OH + NH_4NO_3 + 2H_2O$$

$$R-CHO + 2[Ag(NH_3)_2]OH \longrightarrow R-COONH_4 + 2Ag + 3NH_3 + H_2O$$

Silver mirror

- High quality mirrors are manufactured by using this principle.
- Ketones do not give this test.

33. Write Fehling's solution test. (FSD 12)
Q Describe and give equation for reaction of aldehyde with Fehling's solution. (Grw 08)

Ans. Fehling's Solution Test

"It is an alkaline solution containing cupric tartrate complex ion."

Aliphatic aldehydes form a brick-red precipitate with Fehling's solution. To an aldehyde solution, add Fehling's solution and boil. A brick red precipitate of cuprous oxide is formed.

$$R-CHO + 2Cu(OH)_2 + NaOH \longrightarrow R-COONa + Cu_2O + 3H_2O$$

Brick-red ppt

Ketones and aromatic aldehydes do not give this test.

34. What is Benedict's solution test? (Rwp 12)

Ans. Benedict's Solution

"It is an alkaline solution containing cupric citrate complex ion."

Aliphatic aldehydes form a brick-red precipitate with Fehling's solution. To an aldehyde solution, add Fehling's solution and boil. A brick red precipitate of cuprous oxide is formed.

$$R-CHO + 2Cu(OH)_2 + NaOH \longrightarrow R-COONa + Cu_2O + 3H_2O$$

Brick-red ppt

Ketones and aromatic aldehydes do not give this test.

35. What are factors which make aldehydes more reactive than ketones? (Sgr 10)

Ans. Reactivity of Carbonyl Compounds

The reactivity of carbonyl compounds depends upon two factors:

(i) Electrophilic character of carbonyl carbon:

Alkyl groups are attached with carbonyl carbon in ketones. These alkyl groups donate electrons to carbon atom and decrease its electrophilic character. In this way its reactivity decreases as compared to aldehydes.

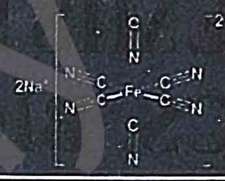
(ii) Stearic Hindrance:

In ketones, bulky alkyl groups create stearic hindrance in the attack of nucleophilic reagent. This makes it less reactive than aldehydes (having one hydrogen atom instead of alkyl groups).

36. What is sodium nitroprusside test?

Ans. Sodium Nitroprusside Test

Ketones produce a wine red or orange red colour on adding alkaline sodium nitroprusside solution drop wise. Aldehydes do not give this test.



37. What is Formalin? Give its use. (D.G Khan 08)

Ans. Formalin

"Formalin is 40% aqueous solution of formaldehyde containing 8% methyl alcohol and 52% water."

It is the trade or commercial name of formaldehyde.

Uses:

It is used:

- as an antiseptic, a disinfectant, a germicide and a fungicide.
- for preserving animal specimens
- for sterilizing surgical instruments

38. Give two tests for distinguishing between aldehyde and a ketone. (LHR 12)

Ans. Distinction between Aldehyde and Ketone

Chemical reaction	Aldehyde	Ketone	Exception
Tollen's Test Ammonical silver nitrate solution	A silver mirror (Ag) is formed	no reaction	Both aliphatic and aromatic aldehydes give this reaction but not ketones
Sodium Nitroprusside Test $Na_4[Fe(CN)_5NO]$	no reaction	A vine red or Orange red colouration	Aldehydes do not give this reaction

39. Write down any four uses of formaldehyde.

Ans. Uses of Formaldehdye

(i) It is used in the manufacture of resins like urea-formaldehyde and plastics such as bakelite.
(ii) It is used in the manufacture of dyes such as indigo, para-rosaniline, etc.
(iii) It is used as a decolourising agent in vat dyeing.
(iv) It is used in the silvering of mirrors.

40. Write down four uses of acetaldehyde. (FSD 08)

Ans. Uses of Acetaldehyde

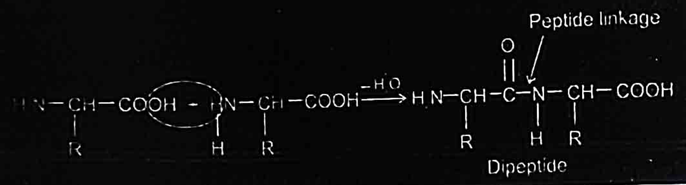
(i) It is used in the production of acetic acid, acetic anhydride, n-butanol, ethanol, 2-ethy-1-hexanol, vinyl acetate, paraldehyde, ethylacetate, etc.
(ii) It is used to make acetaldehyde ammonia used as a rubber-accelerator.
(iii) It is used to make chloral hydrate, ethanal trimer and tetramer. Chloral hydrate and ethanal trimer are both used as hypnotic drugs whereas ethanal tetramer is used as a slug poison.
(iv) It is used as an antiseptic inhalent in nasal infections.

****

Bhatti Academy

In the reactions between amino acids, the carboxyl group of one amino acid and amino group of another amino acid get condensed with elimination of H_2O. The resulting $(-OC-NH-)$ linkage is called peptide linkage or peptide bond.

Example:



39. Differentiate between peptides and proteins. **(Lhr 09, Fsd 12)**

Ans.

Peptides	Proteins
◦ "The compounds formed by the condensation of two or more same or different α – amino acids with the elimination of water are called Peptides."	◦ "A molecule which is obtained by formation of many peptide bonds between α – amino acids having a molecular mass more than 10,000 is called protein.
◦ Its types are: Dipeptide, oligopeptides, polypeptides and proteins.	◦ It has four types: Primary, secondary, tertiary and quaternary proteins.
◦ All peptides are not proteins	◦ All proteins are peptides

40. Differentiate between polypeptides and proteins.

Ans.

Poly Peptides	Proteins
◦ A peptide having a molecular mass up to 10,000 is called polypeptide.	◦ A peptide having a molecular mass more than 10,000 is called protein.
◦ It has no types.	◦ It has four types: Primary, Secondary, Tertiary and quaternary proteins.
Examples: It is itself an example of derived proteins.	**Examples:** Albumin, globulins, Collagen, Legumin etc.

****

CHAPTER 14

MACROMOLECULES

Solved Objective Exercise

Q1. Fill in the blanks.

(i). Macromolecules are built up from small units called ____
(ii). Nylon is a polyamide and terylene is a ____
(iii). Nylon is prepared by the reaction of ____ and hexamethylenediamine.
(iv). Based on their thermal properties, plastics are divided into _____ main classes.
(v). Polyvinyl chloride is a ____ plastic.
(vi). Glucose is stored as ____ in the liver.
(vii). Glucose and fructose are water _____ carbohydrates.
(viii). Protein after digestion changes to ____.
(ix). Purine and pyrimidine are _____ of nucleic acids.
(x). Addition of a plasticizer _____ the flexibility of the polymer.

Answer Key.

(i)	Monomers	(ii)	Polyester
(iii)	Adipic acid	(iv)	Two
(v)	Thermo	(vi)	Glycogen
(vii)	Soluble	(viii)	Amino acids
(ix)	Nitrogenous bases	(x)	Improves

Q2. Indicate True or false.

(i) Nylon-6,6 and terylene are condensation polymers.
(ii) The disposal of plastics does not cause any pollution problem.
(iii) Fructose is a polysaccharide carbohydrate.
(iv) Human beings get no food nutrient from cellulose.
(v) The most abundant and the most important steroid in the human body is vitamin D.
(vi) Enzymes are the compounds containing C,H and O only.
(vii) The degree of unsaturation of fats is measured by their iodine number.
(viii) Activity of an enzyme varies with temperature and pH.
(ix) Nucleic acids are biological catalysts.
(x) The nucleic acids are responsible for protein synthesis in the human body.

Answer Key.

(i)	True	(ii)	False	(iii)	False	(iv)	True	(v)	False
(vi)	False	(vii)	True	(viii)	True	(ix)	False	(x)	True

bhattiAca

Multiple choice questions. Encircle the correct answer.

(i) In which of these processes are small organic molecules made into macromolecules.
(a) the cracking of petroleum fractions. (b) the fractional distillation of crude oil.
(c) the polymerization of ethene (d) the hydrolysis of proteins.

(ii) Which of these polymers is an addition polymer?
(a) Nylon -6.6 (b) polystyrene (c) terylene (d) epoxy resin

(iii) Which of these polymers is a synthetic polymer?
(a) animal fat (b) starch (c) cellulose (d) polyester

(iv) Plastics cause pollution problem because many plastics.
(a) are made from petroleum (b) are very inflammable
(c) burn to produce toxic fumes (d) decompose to produce toxic products.

(v) The fibre which is made from acrylonitrile as monomer:
(a) PVC (b) rayon fibre (c) acrylic fibre (d) polyester fibre

(vi) A polymeric substance that is formed in the liquid state and then hardened to a rigid solid is called as
(a) fibre (b) plastic (c) varnish (d) polyamide resin

(vii) Vegetable oils are
(a) unsaturated fatty acids (b) glycerides of unsaturated fatty acids
(c) glycerides of saturated fatty acids (d) essential oils obtained from plants

(viii) Which one of the following elements in not present in all proteins?
(a) carbon (b) hydrogen (c) nitrogen (d) sulphur

(ix) Which one of the following is a water soluble vitamin?
(a) niacin (b) riboflavin (c) trypsin (d) ascorbic acid

(x) Which one of the following enzymes brings about the hydrolysis of fats?
(a) urease (b) maltase (c) zymase (d) lipase

(xi) The reaction between fat and NaOH is called.
(a) esterification (b) hydrogenolysis (c) fermentation (d) saponification

(xii) Which one of the following statements about glucose and sucrose is incorrect?
(a) both are soluble in water (b) both are naturally occurring
(c) both are carbohydrates (d) both are disaccharides

Solved Exercise MCQ's

Q.No.	Answer	Reason
(i)	(c) The polymerization of ethene	$n\ CH_2 = CH_2 \xrightarrow[100\ atm\ pressure\ traces\ of\ O_2\ (0.1\%)]{400\ C} -(CH_2-CH_2)-_n$ Polyethylene
(ii)	(b) Polystyrene	$n\ CH_2=CH(C_6H_5) \longrightarrow -CH_2-(CH-CH_2)-_n-CH(C_6H_5)-$ Styrene → Polystyrene
(iii)	(d) Polyester	As polyester is man made polymer.
(iv)	(d) decompose to produce toxic products	These toxic products causes air pollution.
(v)	(c) acrylic fibre	$n\ CH_2=CH(CN) \longrightarrow -CH_2-(CH-CH_2)-_n-CH(CN)-$
(vi)	(c) Plastic	Plastic become softened on heating and hardened when cooled.
(vii)	(b) glycerides of unsaturated fatty acids	They convert into glycerides of saturated fatty acids (ghee) by hydrogenation.

(viii)	(d) Sulphur	Sulphur is not essential element of protein while others are essential.
(ix)	(d) Ascorbic acid	Ascorbic acid is vitamin C.
(x)	(d) lipase	Tryglycerides are easily hydrolyzed by lipase to fatty acids and glycerol.
(xi)	(d) Saponification	In this reaction soap is formed.
(xii)	(d) both are disaccharides	Sucrose is disaccharide glucose is not.

Previous Boards MCQ's

1. Which of the following enzymes brings about the hydrolysis of fats? (Grw 09, D.G Khan 08, 10 Sgr 09)
(a) Urease (b) Maltase (c) Zymase (d) Lipase

2. Which of these polymers is an addition polymer? (Grw 11, Lhr 10, Rwp 2008)
(a) Nylon-6,6 (b) Polystyrene (c) Terylene (d) Epoxy resin

3. Degree of polymerization is useful in Rwp 2009)
(a) Structure determination of polymers (b) Calculating the mass of repeating units
(c) calculating the molecular mass of polymers (d) Classification of polymers

4. Enzyme used for the diagnosis of obstructive jaundice is (Rwp 2010)
(a) LDH-1 (b) L-Asparaginase (c) Lipase (d) Alkaline phosphatase

5. Which element is not present in all proteins? (Fsd 2009)
(a) Carbon (b) Hydrogen (c) nitrogen (d) Sulphur

6. Nylon 6,6 is obtained by heating hexamethylenediamine with (Fsd 2010)
(a) Adipic acid (b) acetic acid (c) vinyl chloride (d) Acrylic acid

7. Vegetable oils are (Lhr 08 Fsd Supp 2010)
(a) Unsaturated fatty acids (b) Glyceride of saturated fatty acids
(c) Glycerides of unsaturated fatty acids (d) Saturated fatty acids

8. Which statement about glucose and sucrose is incorrect? (Grw 2008)
(a) Both are soluble in water (b) Both occur naturally
(c) Both are carbohydrates (d) Both are disaccharides

9. The fiber which is made from acrylonitrile as monomer is (Lhr 2009)
(a) PVC (b) Rayon fiber (c) Acrylic fiber (d) Polyester fiber

10. Starch is a polymer of (Lhr 2011)
(a) α – D – glucose (b) β – D – glucose (c) α – D – fructose (d) β – D – fructose

Entry Test MCQ's

1. Which of the following is an example of aldohexose?
(a) Ribose (b). Sucrose (c) Fructose (d) Glucose

2. Which of the following is a non-reducing sugar?
(a) Glyceraldehydes (b) Fructose (c) Glucose (d) Sucrose

3. Which of the following carbohydrates gives a dark blue colour with iodine?
(a) Glucose (b) Starch (c) Cellulose (d) Sucrose

4. Glucose cannot be classified as
(a) Hexose (b) Aldose (c) Carbohydrate (d) Oligosaccharide

5. The proteins with a prosthetic group are known as
(a) Complex proteins (b) Secondary proteins (c) Conjugated proteins (d) Essential proteins

bhattiAcademy

6. Which of the following is a test for proteins?
(a) Molisch's test (b) Baeyer's test (c) Tollen's test (d) Benedict's test
7. The destruction of the biological nature and activity of proteins by heat or chemical agent is called
(a) Dehydration (b) Oxidation (c) Denaturation (d) Polymerization
8. Which of the following is an example of globular protein?
(a) Myosin (Muscle protein) (b) Keratin (fibrous protein)
(c) Collagen (fibrous protein) (d) Haemoglobin
9. Which one of the following is not present in RNA?
(a) Uracil (b) Ribose (c) Thyamine (d) Phosphate
10. Major function of DNA is
(a) To control metabolism (b) To control synthesis of proteins
(c) To catalyse biochemical reactions (d) To transfer genetic information from one generation to the next
11. A nucleotide is made up of
(a) A base and sugar (b) A sugar and phosphoric acid unit
(c) A base and phosphoric acid unit (d) A sugar, a base and a phosphoric acid unit
12. Oil and fats are esters of higher fatty acids with
(a) Ethanol (b) Glycerol (c) Glycol (d) Methanol
13. Lecithin is an example of
(a) A simple lipid (b) Phospholipids (c) Waxes (d) Proteins
14. On hydrolysis of starch, we finally get
(a) Glucose (b) Glucose + fructose (c) Fructose (d) Sucrose
15. Enzymes in the living systems
(a) Provide energy (b) Transport oxygen
(c) Provide immunity (d) Catalyse biochemical processes
16. Glucose is stored in our body as
(a) Fats (b) Lipids (c) Glycogen (d) Sucrose
17. α – D glucose and β – D glucose differ from each other due to the difference in one of the carbon atoms, with respect to its
(a) Number of OH groups (b) Conformation
(c) Configuration (d) Size of hemiacetal ring
18. Which of the following biomolecules contains a non-transition metal ion?
(a) Haemoglobin (b) Vitamin B_{12} (c) Insulin (d) Chlorophyll
19. Which of the following is used in the preparation of nylon?
(a) Adipic acid (b) Isoprene (c) Butadiene (d) Ethylene
20. The widely used PVC is a polymerized product of
(a) $CH_2=CH_2$ (b) CH_2Cl-CH_2Cl (c) $CH_2=CCl_2$ (d) $CH_2=CHCl$
21. Which among the following is a product of addition polymerization reaction?
(a) PVC (b) Terylene (c) Nylon (d) Polyamide
22. Which one of the following is used to make nonstick cookware?
(a) PVC (b) Polyethylene (c) Polystyrene (d) Polytetrafluoroethylene (teflon)
23. Dacron is an example of:
(a) Polyamide (b) Polyethylene (c) Polypropylene (d) Polyester
24. [illegible]rion has a unit
(a) Isoprene (b) Glycol (c) Acrylic acid (d) None of these
25. When [illegible]dium formate is heated with sodalime, it forms:
(b) CH_4 (c) C_2H_4 (d) $CH\equiv CH$
26. [illegible]ich is used to removed ink and rust stains on cloth:
(a) Oxalic acid (b) Alcohol (c) Ether (d) Kerosene oil
Both glycogen and cellulose are polymers of glucose. The main factor that makes them different is
(a) Cellulose has more glucose units
(b) Cellulose has more glucose units and more branch points
(c) Glycogen has more [illegible] points
(d) Glycogen is known as animal starch

28. Which of the following carbohydrate gives positive Fehling solution test
(a) Starch (b) Cellulose (c) Sucrose (d) Glucose
29. The most abundant steroid in human body is
(a) Adrenal hormones (b) Cholesterol (c) Steroids (d) Sex hormones
30. Which of the following is optimum temperature at which most of the enzymes are most active
(a) 100° C (b) 0° C (c) 45° C (d) 35° C
31. Watson and crick noticed that the double stranded structure provide a mechanism
(a) Duplication (b) Replication (c) Reproduction (d) Evolution
32. Polymers can be classified on the basis of
(a) Structure (b) Nature of monomer (c) Thermal properties (d) All of the above
33. Which of the following is an example of thermosetting plastic
(a) Polystyrene (b) Polyvinyl chloride (c) Polyethylene (d) Polyester
34. A Number of possible isomers formed by glucose is
(a) 8 (b) 12 (c) 16 (d) 20
35. Which of the following is the most abundant carbohydrate
(a) Starch (b) Cellulose (c) Glycogen (d) Sucrose
36. Which of the following is an example of simple protein
(a) Oligopeptide (b) Cholesterol (c) Albumin (d) Lecithin
37. These enzymes which link two molecules through the breaking of high energy bonds are called
(a) Lyases (b) Isomerases (c) Ligases (d) Transferases
38. The number of milligrams of KOH required to neutralize one gram of fat is called
(a) Iodine number (b) Acid number
(c) Saponification number (d) Octane number

Additional MCQ's

1. _____ gave hypothesis about macromolecules.
(a) Carothers (b) Millikan (c) Staudinger (d) Kekule
2. _____ is not found in plants
(a) Glucose (b) Fructose (c) Sucrose (d) Lactose
3. _____ serve as weather resistant paints
(a) Co-polymers (b) Ter-polymers (c) Both a and b (d) None of these
4. Empirical formula for carbohydrates is:
(a) $C_x(H_2O)_x$ (b) $C_{2x}(H_2O)_x$ (c) $C_x(H_2O)_y$ (d) $C_x(H_2O)_{2y}$
5. Carbohydrates are polyhydroxy compounds of:
(a) Aldehydes (b) Ketones (c) Fats (d) Both a and b
6. Addition polymerization involves _____ mechanism
(a) Aldol mechanism (b) Cannizzaro mechanism
(c) Free radical mechanism (d) All of these
7. Which one of the following is an addition polymer?
(a) Nylon 6, 6 (b) Epoxy resins (c) Polyester resin (d) Polyvinyl chloride
8. Which one is used as a binder for emulsion paints?
(a) PVC (b) Nylon 6, 6 (c) PVA (d) Acrylic resins
9. A condensation polymer formed by the condensation of adipic acid and hexamethylenediamine is
(a) Epoxy Resins (b) Nylon 6, 6 (c) Polyester resins (d) PVC
10. _____ cannot be hydrolyzed
(a) Monosaccharides (b) Oligosaccharides (c) Polysaccharides (d) None
11. Which one of the following is a disaccharide?
(a) Glucose (b) Sucrose (c) Fructose (d) Glyceraldehyde

bhattiAcademy

12. Fructose, a hexose sugar have a_____ structure
(a) Pentagonal (b) Hexagonal (c) Tetrahedral (d) Pyramidal
13. Which one of the following is a trisaccharide?
(a) Glucose (b) Sucrose (c) Raffinose (d) Maltose
14. Molecular formula for starch and cellulose is
(a) $C_x(H_2O)_y$ (b) $C_6H_{12}O_6$ (c) $C_{16}H_{32}O_{16}$ (d) $(C_6H_{10}O_5)_n$
15. Glucose store in animals in the form of
(a) Sucrose (b) Glycogen (c) Starch (d) Glucose
16. Starch is a polymer of
(a) β-D-glucose (b) β-L-glucose (c) α-L-glucose (d) α-D-glucose
17. Cellulose is a polymer of
(a) β -D-glucose (b) Glucose & fructose (c) α-D-glucose (d) None of these
18. How many C-atoms are present in the structure of Steroid Nucleous?
(a) 17 (b) 71 (c) 27 (d) 18
19. Which is used as "Sweetening agent" in confectionery
(a) Fructose (b) Glucose (c) Sucrose (d) Galactose
20. Enzymes speed up reactions by factor of upto
(a) 10^{10} (b) 10^{20} (c) 10^{15} (d) 10^{30}
21. The non-protein part of an enzyme is known as:
(a) Co-factor (b) Substrate (c) Active site (d) None of these
22. The enzymes which catalyzes oxidation reduction reactions are
(a) Ligases (b) Lyases (c) Transferases (d) Oxidoreductases
23. The conversion of fumaric acid to maleic acid in the presence of fumarase enzyme is an example of
(a) Ligases (b) Lyases (c) Transferases (d) Oxidoreductases
24. The optimum temperature at which an enzyme will catalyze the reaction at maximum rate is at or around
(a) 30°C (b) 25°C (c) 37°C (d) 40°C
25. In the body nucleic acids occur as a part of the conjugated proteins called
(a) Ribonucleoproteins (b) Deoxyribonucleoproteins
(c) Nucleoproteins (d) None of these
26. Purines inlcude
(a) Adenine and thyamine (b) Adenine and guanine
(c) Cytosine and thyamine (d) Cytosine and uracil
27. In RNA, thyamine does not occur and its place is taken by
(a) Guanine (b) Cytosine (c) Uracil (d) Adenine
28. _____ is a type of compound lipid
(a) Sphingolipid (b) Terpenes (c) Sterols (d) All of these
29. Which one of the following is the precursor of steroids?
(a) Ergosterol (b) Cholesterol (c) Ergocalciferol (d) Phospolipid
30. In hardening of oils which one occur as catalyst:
(a) Copper (b) Chromium (c) Nickel (d) Iron
31. _____ detects the number of double bonds
(a) Iodine number (b) Neutralization (c) Acidic number (d) Basic number
32. Ergocalciferol is a _____ lipid
(a) Compound (b) Conjugated (c) Simple (d) Derived
33. If molecular mass of repeating unit of a polymer is 63 and DP is 1000, then mol. mass of polymer is
(a) 63000 (b) 937 (c) 1063 (d) 6300
34. Polymer formed by polymerization of three monomers is:
(a) Homopolymer (b) Terpolymer (c) Copolymer (d) None
35. Vinyl acetate reacts with butyl maleate to form a polymer
(a) Terpolymer (b) Homopolymer (c) Copolymer (d) None
36. Triglyceride with no double bonds have Iodine number
(a) Zero (b) One (c) 1/2 (d) Two
37. Polymer used in making gramophone recorders is
(a) PVA (b) PVC (c) Polystyrene (d) None

38. PVA is supplied in a number of grades differing in
(a) DP (b) PV (c) AP (d) None
39. Resins used for paints in car industry are:
(a) PVA (b) Acrylic resins (c) Polyester resins (d) Epoxy resins
40. When a nitrogenous base combine with a sugar it is called:
(a) Ribose (b) Nucleotide (c) Nucleoside (d) None of these
41. Which one of the following give test with Fehling's solution:
(a) Glucose (b) Fructose (c) Sucrose (d) Lactose
42. Which of the following is not a characteristic of lipids:
(a) They are insoluble in water
(b) Their primary building blocks are fatty acid, glycerol and sterols
(c) They are utilized by non-living organisms
(d) They are good source of energy
43. The increased quantities of cholesterol in blood causes:
(a) Plaque (b) Blood pressure (c) Heart diseases (d) All of these
44. The structure of proteins can be disrupted easily by:
(a) Heating (b) Change in pH
(c) Using strong oxidizing and reducing conditions (d) All of these

ANSWERS TO MCQ'S

Previous Board MCQ's

Q.No.	Answer	Reason
1.	(d) Lipase	Tryglycerides are easily hydrolyzed by lipase to fatty acids and glycerol.
2.	(b) Polystyrene	$n\,CH_2=CH(C_6H_5) \longrightarrow -CH_2-(CH(C_6H_5)-CH_2)_n-CH(C_6H_5)-$ (Styrene → Polystyrene)
3.	(c) calculating molecular mass of polymers	Molecular mass of polymer = D.P × Molecular mass of repeating unit.
4.	(d) Alkaline phospatase	Alkaline phosphatase is raised in rickets & obstructive jaundice.
5.	(d) Sulphur	Sulphur is not essential element of protein while others are essential.
6.	(a) adipic acid	$nHOC(CH_2)_4COH + nH_2N(CH_2)_6NH_2 \longrightarrow -C(CH_2)_4C[NH(CH_2)_6NHC(CH_2)_4C]_n NH(CH_2)_6NH-$ (Adipic acid, Hexamethylenediamine, Nylon-6,6)
7.	(b) Glycerides of unsaturated fatty acids.	$CH_2(OOC(CH_2)_7CH=CH(CH_2)_7CH_3)-CH(OOC(CH_2)_7CH=CH(CH_2)_7CH_3)-CH_2(OOC(CH_2)_7CH=CH(CH_2)_7CH_3)$ Glyceryl trioleate (an oil)
8.	(d) Both are disaccharides	Sucrose is disaccharide glucose is not.

bhattiAcademy

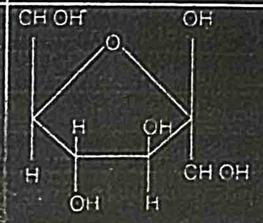
9.	(c) Acrylic fiber	$n\,CH_2=CH \longrightarrow \cdots -CH_2-\underset{CN}{CH}-CH_2-\underset{CN}{CH}-\underset{CN}{CH}-$
10.	(a) α – D - glucose	Strach is polymer of α - D – Glucose having two types amylase & amylopectin.

Entry Test MCQ's

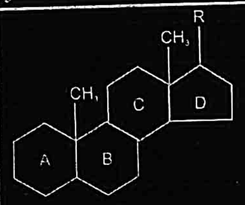
Q.No.	Answer	Reason
1.	(d) Glucose	Ribose Aldopentose. Fructose = Ketohexose. suerose = disaccharide
2.	(d) Sucrose	It is disaccharide
3.	(b) Starch	Amylose present in starch gives deep blue colour with iodine.
4.	(d) Oligosaccharide	Glucose is monosaccharide not oligosaccharide.
5.	(c) conjugated proteins	These proteins are conjugated with prosthetic group.
6.	(a) Molisch's test	Tollen's, Beayer's & Benediet's test are for aldehydes.
7.	(c) denaturation	The denaturation may be reversible or irreversible.
8.	(d) Haemoglobin	Myosin is musele protein, collagen is fibrous & keratin is also fibrous.
9.	(c) Thymine	In RNA tiymine is replaced by uracil.
10.	(d) to transfer genetic information from one generation to next	DNA is dinucleic acid which helps in genetic transportation.
11.	(a) a base and sugar	Nitrogenous base and ribose or deoxyribose sugar.
12.	(b) glycerol	They are glycerides of fatty acids.
13.	(a) a simple lipid	Lecithin conjugated with protein forms lipoprotein.
14.	(b) glucose + fructose	Because they are monomers of sucrose.
15.	(d) catalyse biochemical processes	Enzymes are biological catalysts.
16.	(c) glycogen	Due to storage of glucose as glycogen it is called animal starch.
17.	(c) configuration	Configuration means arrangement of groups in space
18.	(a) haemoglobin	Haemoglobin contains Fe which is transition element.
19.	(a) adipic acid	Adipic acid & hexamethylene diamine are two monomers of nylon.
20.	(d) $CH_2 = CHCl$	$CH_2 = CHCl$ (vinyl chloride) is polymerized to form PVC.
21.	(a) PVC	Nylon, terylene and polyamide are condensation polymers.
22.	(d) Polytetrafluoroethylene (Teflon)	Teflon is formed by polymerization of $CF_2 = CF_2$.
23.	(d) Polyester	Dacron is formed by condensation polymerization of terethalic acid & ethylene glycol.
24.	(d) None of these	Orlon has a unit acrylonitrile.
25.	(a) H_2	$HCOO\,Na^+ + NaOH \xrightarrow{\Delta, CaO} H_2 + Na_2CO_3$
26.	(d) Kerosene oil	Kerosene oil reacts with stains on cloth and remove them from cloth.
27.	(d) glycogen is known as animal starch	Cellulose is plant starch while glycogen is animal starch.

28.	(d) glucose	Glucose is aldehyde so it gives positive Fehling's test.
29.	(b) cholesterol	It occurs in all animal tissues but only in a few higher plants.
30.	(d) 35°	35 – 37°C is optimum temperature for enzymatic action.
31.	(b) replication	Replication is process through which genetic information can be duplicated.
32.	(a) all of the above	Polymers are large sized molecules build up by small molecules.
33.	(d) polyester	As polyester becomes hard on heating.
34.	(c) 16	Glucose
35.	(b) cellulose	100 billion tons of cellulose are produced each year by plants.
36.	(c) albumin	Albumin is egg protein.
37.	(c) ligases	Acetyl-S-COH, a carboxylase and succinic thiokinase.
38.	(b) acid number	Acid no. tells the amount of free fatty acids present in fat or an oil.

Additional MCQ's

Q.No.	Answer	Reason
1.	(c) staudinger	Staudinger gave this hypothesis in 1920.
2.	(d) lactose	Lactose is present in milk of all animals and absent in plant.
3.	(b) Ter-polymer	e.g., Acrylin resins serve as weather resistant paints.
4.	(c) C × $(H_2D)y$	Carbohydrate means hydrate of carbon.
5.	(d) Both a and b	Glucose is aldehyde & fructose is ketone.
6.	(c) Free radical mechanism	It involves three steps: initiation, propagation & termination.
7.	(d) Polyvinyl chloride	$n\,CH_2=CH \longrightarrow -CH-\underset{Cl}{CH}-CH_2-\underset{Cl}{CH}-$ Vinyl chloride → Polyvinyl chloride (PVC) It is an additional polymer.
8.	(c) PVA	PVA = polyvinyl acetate.
9.	(b) Nylon-6, 6	$nHOOC(CH_2)_4COH + nH_2N(CH_2)_6NH \longrightarrow C(CH_2)_4C[NH(CH_2)_6NHC(CH_2)_4C]NH(CH_2)_6NH$ Adipic acid, Hexamethylenediamine → Nylon-6,6
10.	(a) Monosaccharides	Monosaccharides are simple sugars and cannot be hydrolyzed.
11.	(b) Sucrose	Sucrose is formed from two monosaccharides glucose & fructose.
12.	(a) Pentagonal	
13.	(c) Raffinose	It yields glucose, fructose & galactose on hydrolysis.
14.	(d) $(C_6H_{10}O_5)n$	So, starch and cellulose are isomers.

pnaeiAcademy.com

15.	(b) Glycogen	Glycogen is called animal starch.
16.	(d) α – D-glucose	Starch is not pure compound but a mixture of two polysaccharides.
17.	(a) β – D – Glucose	It is unbranched polymer consisting of large number of glucose residues join to each other through β-1-4 linkages.
18.	(a) 17 (C – atoms)	 Structure of Steroid Nucleus
19.	(a) Fructose	It is used in baking goods.
20.	(b) 10^{20}	This shows the amazing efficiency of enzymes.
21.	(a) Co-factor	It is also called co-enzyme.
22.	(d) oxidoreductases	Oxido -- oxidation, reducto – reduction etc.
23.	No answer is correct	This is transfer of isomers which is catalayzed by isomerases.
24.	(c) 37°C	This temperature is normal body temperature.
25.	(c) Nucleopratein	Nucleo – nucleotide, protein
26.	(b) Adenine and Guanine	Adenine & Guanine are represented by 'A' and 'G' respechiely
27.	(c) Uracil	Uracil is special nitrogenous base which is present in RNA.
28.	(a) sphingolipid	It includes radicals in addition to fatty acids.
29.	(b) cholesterol	Cholesterol is most abundant animal sterol.
30.	(c) Nickel	Vegetable oil + H_2 $\xrightarrow{Ni}$ Vegetable ghee
31.	(a) iodine number	A fat with no double bond has zero iodine number.
32.	(d) Derived	Ergocalciferol is vitamin D_2 which is derived lipid.
33.	(a) 63000	Mol. mass of polymer = D.P × mol. mass of repeating unit = 1000 × 63 = 63000
34.	(b) Terpolymer	e.g., Acrylic resin is terpolymer formed by three monomers.
35.	(c) copolyment	Because two kinds of monomers polymerize.
36.	(a) zero	Iodine number is a measure of number of double bond.
37.	(b) PVC	PVC is on addition polymer which has unit $CH_2 = CHCl$.
38.	(a) DP	DP = Degree of polymerization.
39.	(b) Acrylic resins	Acrylic resin has units. Acrylic acid, methyl methacrylate & acrylonitrile.
40.	(c) nucleoside	Nucleoside is a combination of nitrogenous base & sugar.
41.	(a) Glucose	Because glucose is an aldehyde.
42.	(c) They are utilized by 7 non-living organisms 5	Lipids are utilized by living organisms and also produced by living organisms.
43.	(d) All of these	So increased quantity of cholesterol is harmful.
44.	(d) All of these	This process is called denaturation of protein.

Short Answers Questions

1. What are macromolecules? Give two examples. (Grw 08)

Ans. Macromolecules

"Macromolecules or polymers are large molecules built up from small repeating units called monomers."

- All polymers are macromolecules but all macromolecules are not polymers.
- Macromolecules may be inorganic or organic (Biopolymers, synthetic polymers etc.)

Examples:

Diamond (inorganic macromolecule)
Lipids (organic macromolecule)

2. What are polymers? Discuss different types of polymers. (Rwp 07)

Ans. Polymers

"A large size molecule build up by the repetition of small and simple chemical units (monomers) is called polymer."

Types of Polymers:

(1) On the basis of Structure:
(i) Linear polymers (ii) Branched chain polymers (iii) Cross linked polymers

(2) On the basis of Monomers:
(i) Homopolymers (ii) Copolymers (iii) Terpolymers

(3) On the basis of Heating effect:
(i) Thermoplastic polymers (ii) Thermosetting polymers

3. Classify the polymers on the basis of types of monomers. Define co-polymers with one example. (Rwp 09)

Ans. Types of Polymers on the Basis of Monomers

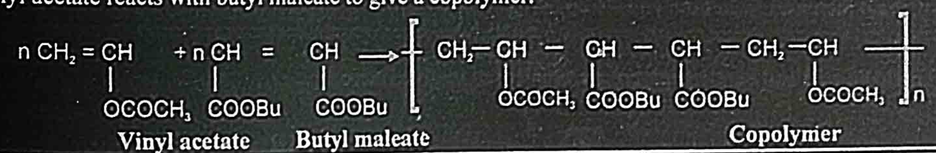
On the basis of monomers, polymers are of three types:
(i) Homopolymers (ii) Copolymers (iii) Terpolymers

Copolymer:

"A polymer which is formed by the polymerization of two different monomers together is called co-polymer."

For example:

Vinyl acetate reacts with butyl maleate to give a copolymer.



Vinyl acetate Butyl maleate Copolymer

4. How the degree of polymerization helps to determine the molar mass of the polymer? (Fsd 10)

Ans. Degree of Polymerization (D.P)

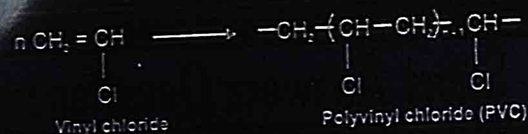
"The number of repeating units which determine the length of the polymer chain is called degree of polymerization".

Calculation of molecular mass:

The molecular mass of a polymer is the product of molecular mass of the repeating unit and the DP.

Example:

Vinyl chloride polymerizes to give polyvinyl chloride (PVC).



Where the DP of polyvinyl chloride is 1000 and molecular mass of its repeating unit is 62.5.

Molecular mass of PVC = Molecular mass of repeating unit × DP

= 62.5 × 1000

= 62.5×1000

= 62500

Hence, the molecular mass of polyvinyl chloride is 62500.

5. What are thermoplastic and thermosetting polymers? (D.G Khan 08)
OR Differentiate between thermoplastic and thermosetting polymers.

Ans.

Thermoplastic Polymers	Thermosetting polymers
◦ "A polymer which becomes softened repeatedly on heating and hardened when cooled with a little change in properties is called thermoplastic polymer".	◦ "A polymer which becomes hard on heating and cannot be softened again is called thermosetting polymer".
◦ They can be remoulded, recast and reshaped.	◦ They cannot be remoulded or reshaped.
◦ Weak intermolecular forces are present which becomes weak on heating.	◦ Strong inter molecular forces are present that is why thermosetting polymer, on heating, decomposes instead of melting.
◦ They are less brittle and soluble in some organic solvents.	◦ They are more brittle and insoluble in organic solvents.
◦ They have usually linear structures.	◦ They have three dimensional cross-linked structures.
Examples: Polyethylene, PVC, Teflon, etc.	Examples : Bakelite, Ureaformaldehyde resin, Terylene, etc.

6. Explain with example the term "Condensation Polymerization." (Fsd 09) (Rwp 08)

Ans. Condensation Polymerization

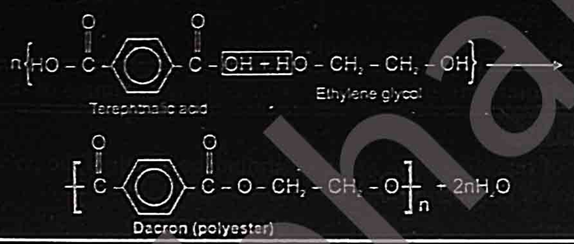
"The polymerization in which monomers having functional group combine to give a product (polymer) with the elimination of small molecule is called condensation polymerization".

◦ It does not involve free-radical mechanism whether it is ionic in nature.
◦ It completes in a single step.

The length of chain increases from both ends/ sides.

Example:

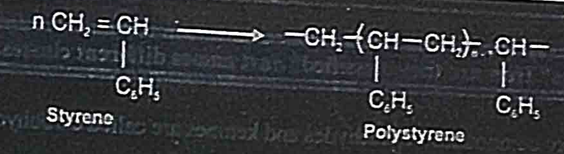
Terephthalic acid and ethylene glycol are condensed to give Dacron.



7. How polystyrene is prepared? Give its two uses. (D.G.Khan 08, Grw 08)

Ans. Preparation of Polystyrene

It is also an addition polymer and is obtained by the polymerization of styrene in the presence of a catalyst.



Uses:

Polystyrene is used in the manufacture of:

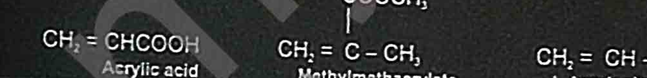
(i) Food containers (ii) Cosmetic bottles (iii) Toys (iv) Packing materials, etc.

8. What are acrylic resins? Give their two uses. (Lhr 09)

Ans. Acrylic Resins

Acrylic resins are closely related to vinyl resins.

The most important monomers of acrylic resins are:



Uses:-

It is used in the manufacturing of:

(i) plastics (ii) paints for car industry (iii) water based weather resistant paints

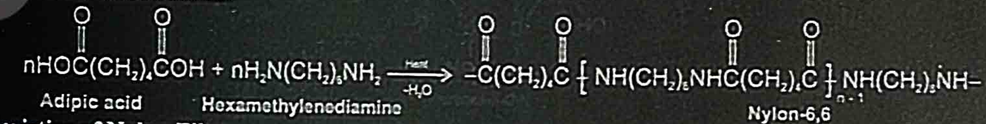
9. Write a short note on Nylon-6,6. (Grw 09)
OR What are polyamides? Give the formation of Nylon-6,6. (Sgr 10)

Ans. Polyamides

"The resins formed by the condensation of polyamines with aliphatic dicarboxylic acids are called polyamides."

Formation of Nylon 6, 6:

Nylon-6,6 is the most important polyamide. It is obtained by heating adipic acid and hexamethylene diamine, both of which have six carbon atoms.



Characteristics of Nylon Fibre:

It has high strength, elasticity, toughness and abrasion resistance.

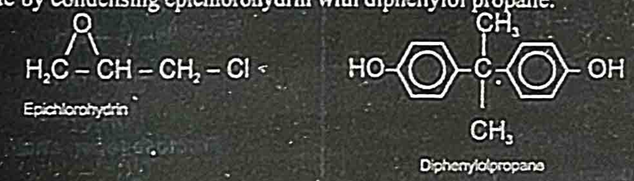
Use:

Nylon is mainly used as a textile fibre.

10. Define epoxy resins. Give their importance. (Fsd 12) (Grw 11)

Ans. Epoxy Resins

◦ The epoxy resins are fundamentally polyethers but retain their name on the basis of their starting materials and the presence of epoxide group in the polymer.
◦ The epoxy resin is made by condensing epichlorohydrin with diphenylol propane.



Importance:

(i) The major use of epoxy resins is in coating materials which give toughness, flexibility, adhesion and chemical resistance.
(ii) Industrial materials, thermal power stations, packing materials are coated with epoxy paints.
(iii) Dams, bridges, floors etc. are painted with epoxy resins.

PhattiAcademy

11. What are carbohydrates? How are they classified? Just names different classes. (D.G. Khan 09)

Ans. Carbohydrates

"The polyhydroxy compounds of aldehydes and ketones are called carbohydrates."

- They are the most abundant biomolecules on earth.
- The name carbohydrate (hydrate of carbon) is derived from the fact that the first compound of this group which was studied had an empirical formula $C_x(H_2O)_y$.

Classification of Carbohydrates:

The commonly described classification is given below.

(i) Monosaccharides

(ii) Oligosaccharides

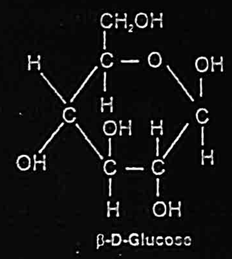
(iii) Polysaccharides

12. What are monosaccharides? Give cyclic structure of β – D – Glucose. (Rwp 08)

Ans. Monosaccharides

- These are simple sugars which cannot be hydrolyzed.
- They have an empirical formula $(CH_2O)_n$ where n = 3 or some large number.
- There are 20 monosaccharides which occur in nature.

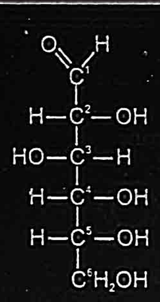
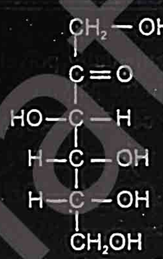
Structure of β – D – Glucose :



β-D-Glucose

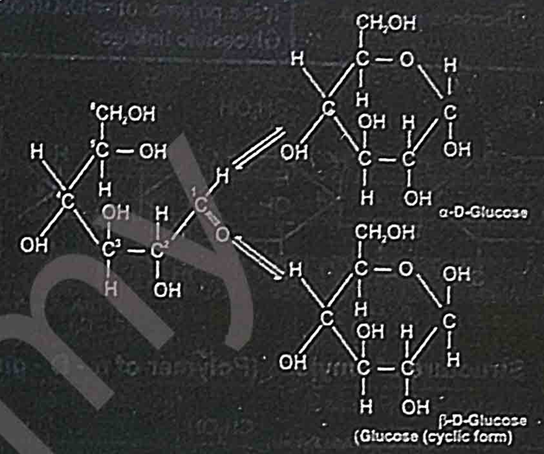
13. Write open chain structures of (a) Glucose (b) Fructose

Ans.

Open Chain Structure of Glucose	Open Chain Structure of Fructose
 Glucose (open chain form)	 Fructose (open chain form)
2, 3, 4, 5, 6-Pentahydroxyhexanal	1,3,4,5,6-Pentahydroxy- 2-hexanone

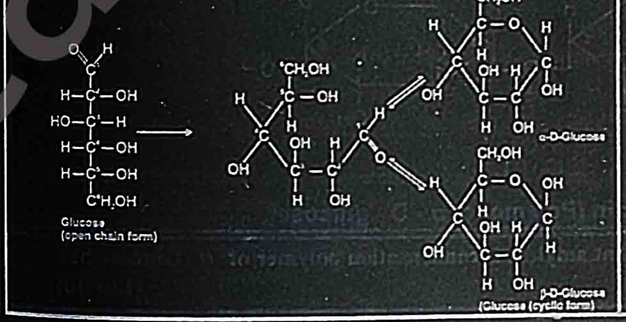
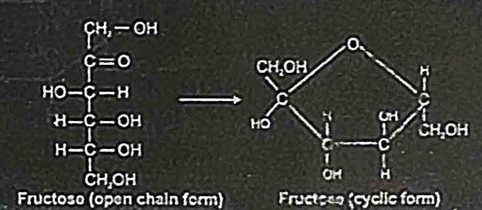
14. Write cyclic structures of glucose.

Ans. Cyclic Structures of Glucose



15. Differentiate between Glucose and Fructore.

Ans.

Glucose	Fructose
∘ It is aldohexose.	∘ It is ketohexose.
∘ It is less sweeter than fructose.	∘ It is many times sweeter than glucose.
∘ It needs insulin for proper metabolizing.	∘ It needs no insulin to be processed.
 Glucose (open chain form) ⟶ α-D-Glucose, β-D-Glucose (Glucose (cyclic form)	 Fructose (open chain form) ⟶ Fructose (cyclic form)

16. What is starch? Differentiate between amylose and amylopectin.

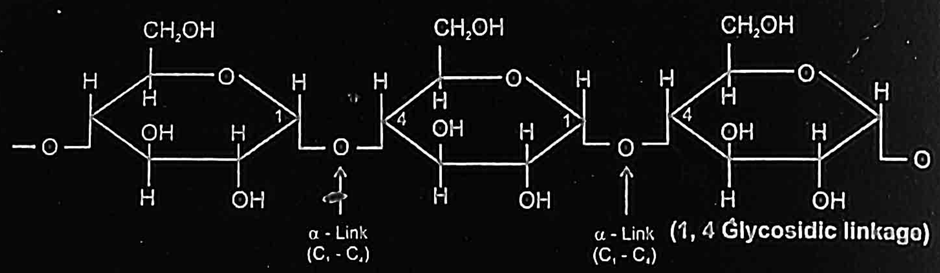
Ans. Starch

It is a white amorphous substance with no taste and smell. It is the most important source of carbohydrates in human diet. Starch is a polymer of **α-D-glucose**. The chief commercial sources of starch are wheat, rice, maize, potatoes and barley.

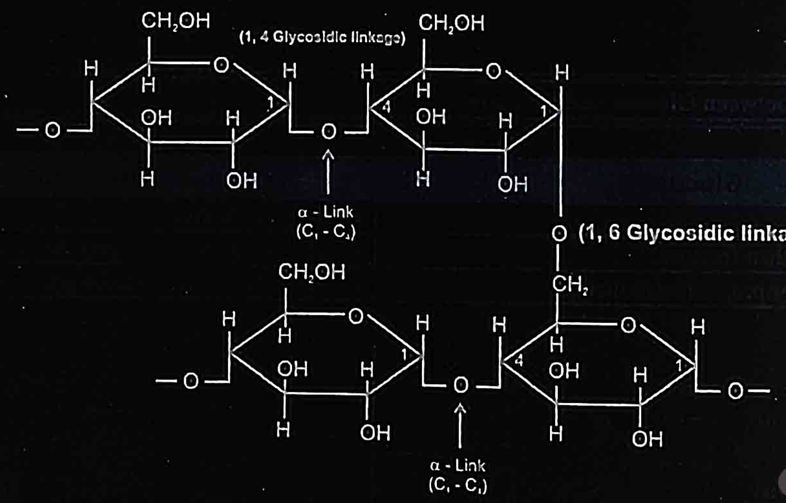
Amylose	Amylopectin
It is soluble in water.	It is insoluble in water.
It gives deep blue colour with Iodine.	It gives no colour with Iodine.
Natural starch consists of 10-20% amylose.	Natural starch consists of 80-90% amylopectin.

bhattiAca

It is a linear polymer.	It is a highly branched polymer.
It is a polymer of ∝-D-Glucose having 1, 4 Glycosidic linkage.	It is a polymer of ∝-D-Glucose having 1, 4 and 1, 6 Glycosidic linkages.



Structure of amylose (Polymer of α - D - glucose)

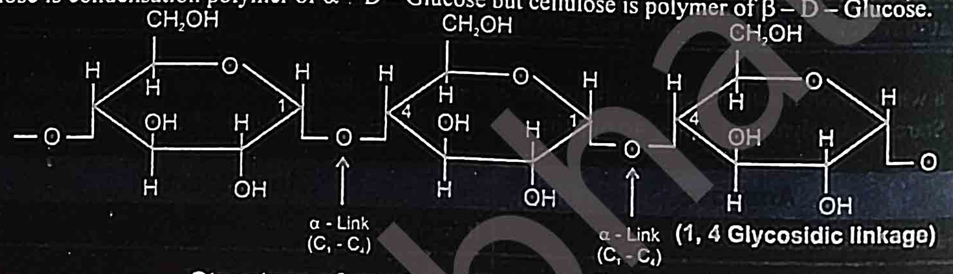


Structure of amylopectin (Polymer of α - D - glucose)

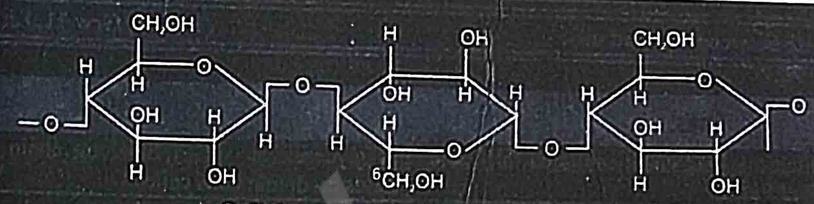
17. Justify by writing their structural formulas that amylose is condensation polymer of α - Glucose but cellulose is polymer of β-D-Glucose. (Lhr 10)

Ans. Amylose and Cellulose

Amylose is condensation polymer of α – D – Glucose but cellulose is polymer of β – D – Glucose.



Structure of amylose (Polymer of α - D - glucose)



Cellulose (Polymer of β-D-Glucose)

18. Differentiate between conjugated and derived proteins. Give one example in each case. (Grw 10)

Ans.

Conjugated Proteins	Derived Proteins
Those proteins which are attached or conjugated to some non-protein groups are called compound or conjugated proteins.	The protein which are derived from simple and conjugated proteins.
Examples Phospho-proteins are conjugated with phosphoric acid.	**Example:** Proteoses enzymes.

19. Explain denaturation of proteins. (Fsd 12)

Ans. Denaturation of Proteins

The structure of the natural proteins is responsible for their biological activity. The structure of proteins can be disrupted easily by:

(i) Heat (ii) Ultraviolet radiations (iii) Change in pH

(iv) Under strongly oxidizing or reducing conditions.

Under such conditions the proteins undergo denaturation.

For example:

The denaturation of albumin, the principal component of egg white, takes place when it is cooked. The helical structure of albumin is disrupted.

Denaturation can be reversible or irreversible. The denaturation of albumin is irreversible.

20. Write down uses of proteins.

Ans. Uses (importance) of Proteins

Biological Importance:

(i) Proteins take an essential part in the formation of protoplasm which is the essence of all forms of life.

(ii) Nucleoproteins which are complexes of proteins with nucleic acids serve as carriers of heredity from one generation to the other.

(iii) Enzymes which are biological catalysts are protein in nature. Without them life is not possible.

(iv) Many proteins have specialized functions. Haemoglobin acts as a carrier of O_2. Some proteins act as hormones which have regulatory function. For example insulin and Thyroxine etc.

Industrially Importance:

(i) The use of leather made by tanning of hides. This is essentially a precipitation of the proteins with tannic acid.

(ii) Gelatin is obtained by heating bones, skin and tendons in water. It is used in bakery goods.

(iii) Caesein is another protein used in the manufacture of buttons and buckles.

21. What are lipids?

Ans. Lipids

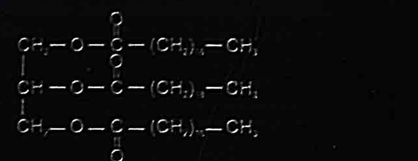
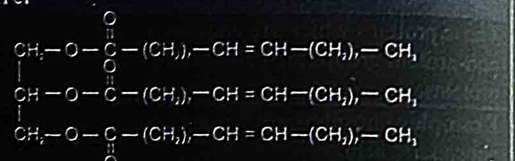
"The naturally occurring organic compounds of animals and plants origin which are soluble in organic solvents and belong to a very heterogeneous group of substances are called lipids."

Fats and oils are examples of Lipids.

bhattiAca

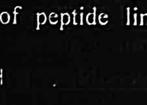
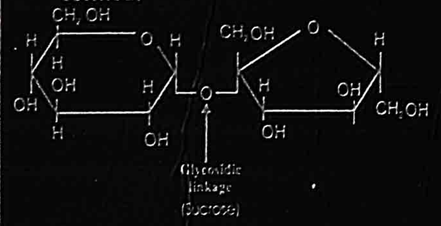
22. Differentiate between fats and oils. (Lhr 11, Grw 11, Lhr 12, Fsd 08)

Ans.

Fats	Oils
A glyceride in which the long chain saturated fatty acids predominate is called Fat.	A glyceride in which the long chain unsaturated fatty acids predominate is called Oil.
They are usually semi-solids or solids.	They are usually liquids.
They have high melting and boiling points.	They have low melting and boiling points.
Fats are generally obtained from animals.	Oils are generally obtained from plants and marine animals.
Structure:  Glyceryl tristearate (a fat)	Structure:  Glyceryl trioleate (an oil)

23. What is the difference between a glycosidic linkage and peptide linkage? (Sgr 09, D.G Khan 09)

Ans.

Glycosidic Linkage	Peptide Linkage
1. The linkage formed between two monomers of carbohydrates is called Glycosidic linkage.	1. The linkage formed between two amino acids is called peptide linkage
2. It is represented as $-C-O-C-$.	2. It is represented as 
3. As a result of this linkage, disaccharide is formed.  (Glycosidic linkage) (Sucrose)	3. As a result of peptide linkage, peptide is formed.  Peptide linkage (Dipeptide)

24. What is saponification? Give one example. (Lhr 08, Lhr 12)

Ans. Saponification Number

"The number of milligrams of potassium hydroxide or sodium hydroxide required to saponify one gram of the fat or oil is called saponification number."

For example:



807g of glycerol tripalmitate requires KOH = 168000 mg

1g of glycerol tripalmitate requires $KOH = \frac{168000\,mg \times 1\,g}{807\,g} = 208\,mg$

Hence, the saponification number of glycerol tripalmitate is 208.

25. What is rancidity of fats and oils and what is its cause? (Mtn 12)

Ans. Rancidity of Fats and Oils

Fats or oils are liable to spoilage and give off an adour known as rancidity.

Causes:

It is mainly caused by the hydrolytic or oxidative reactions which release foul smelling aldehydes and fatty acids. Oils from sea animals which contain a relatively high proportion of unsaturated acid chains deteriorate rapidly.

26. What is iodine number? (Grw 12, Lhr 11, Lhr 09)

Ans. Iodine Number

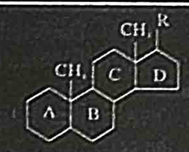
"The number of grams of iodine which will add to 100 grams of a fat or an oil is called iodine number."

- The extent of unsaturation in a fat or an oil is expressed in terms of its iodine number.
- The value of iodine number depends on the number of double bonds present in the acid component of the glycerides.
- The glycerides with no double bonds have zero iodine number.

27. What are steroids? Write the structure of steroid nucleus. (Sgr 09)

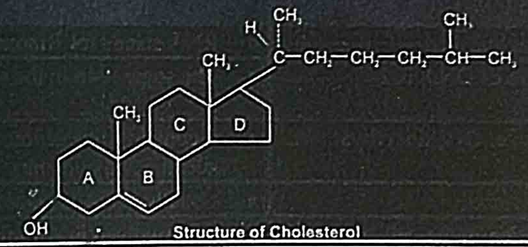
Ans. Steroids

Steroids are naturally occurring lipids. Their parent nucleus has perhydrocyclopentanophenanthrene component which consists of three six-membered rings (A, B and C) and one five-membered ring (D). These rings are joined or fused to each other and have a total of 17-C atoms.


Structure of Steroid Nucleus

28. Write down the structure of cholesterol.

Ans. Structure of Cholesterol


Structure of Cholesterol

29. What are enzymes? Give their two types.

Ans. Enzymes

"The reaction catalysts of biological systems produced by living cells and are capable of catalyzing chemical reactions are called enzymes."

Types of Enzymes

1. Oxidoreductases:

These enzymes catalyze oxidation-reduction reactions.

Examples: Oxidase, dehydrogenase and peroxydase.

2. Transferases:

These enzymes bring about an exchange of the functional group such as phosphate or acyl between two compounds.

Example: Phospho-transferases, etc.

bhattiAcademy

30. Just name four factors affecting the activity of enzymes. (Grw 09)

Ans. Factors Affecting Activity of Enzymes

The factors which affect the activity of enzymes are:

(i) Enzyme concentration.
(ii) Temperature
(iii) Effect of pH
(iv) Radiations

31. What is the effect of these factors upon reactivity of enzymes?
(a) Radiation (b) Enzyme concentration

Ans.

(a) Radiation

Generally enzymes are readily inactivated by exposure to ultraviolet light, beta rays, gamma rays and X-rays.

(b) Enzyme Concentration

The rate of an enzymatic reaction is directly proportional to the concentration of the substrate. The rate of reaction is also directly proportional to the square root of the concentration of enzyme. It means that the rate of reaction also increases with the increasing concentration of enzyme.

32. How many types of nucleic acids are present and what is their function? (Mtn 12)

Ans. Types of Nucleic Acids and their Functions

Nucleic acids are of two types:

(i) Deoxyribonucleic acid (DNA)
(ii) Ribonucleic acid (RNA)

Functions:

DNA carries the genetic information in the cell and RNA is involved in putting the genetic information to work in the cell.

33. Differentiate between DNA and RNA. (Rwp 10, Lhr 12)

Ans.

DNA	RNA
◦ DNA stands for Deoxyribonucleic acid	◦ RNA stands for Ribonucleic acid.
◦ The sugar used in the structure of DNA is 2-deoxyribose.	◦ The sugar used in the structure of RNA ribose.
◦ It contains nitrogenous bases i.e. Cytosine, thyamine, adenine and guanine.	◦ It contains nitrogenous bases i.e. Cytosine, and uracil, adenine and guanine.
◦ It is double stranded.	◦ Usually, RNA is single stranded.
◦ It carries the genetic information in the cell.	◦ It is involved in putting the genetic information to work in the cell.

****

bhattiacademy

CHAPTER 15

COMMON CHEMICAL INDUSTRIES IN PAKISTAN

Solved Objective Exercise

Q.1 Fill in the blanks.

(i) Fertilizers enhance the natural _____of the soil.
(ii) Micro-nutrients are required in quantity ranging from _____per acre.
(iii) Ammonia contains _____ % nitrogen.
(iv) Manure is an _____ material used to fertilize land.
(v) Cement was first introduced by an English mason _____.
(vi) Phosphorus is required to stimulate_____ of plant.
(vii) In Pakistan, bleaching of pulp is carried out with_____
(viii) Cement is generally manufactured by using ____ process.
(ix) The use of cement in the construction of building is based on its property of _____when its paste with water is allowed to stand for sometime.
(x) Lignin is an _____ polymer and causes paper to become brittle.

Answer Key.

(i)	Fertility	(ii)	6-200 g
(iii)	82%	(iv)	organic
(v)	Joseph Aspdin	(vi)	Early growth
(vii)	Chlorine dioxide or Sodium hypochlorite and hydrogen peroxide	(viii)	Wet
(ix)	Setting	(x)	Aromatic

Q.2 Indicate true or false.

(i) Potassium fertilizers are especially used for tobacco and corn.
(ii) Ammonia is used in gaseous state while all other fertilizers are used in solid form.
(iii) In wet process for the manufacture of cement, grinding of raw material is done in the presence of water.
(iv) The total product of cement in Pakistan is 56,30,100 metric tons/annum.
(v) In neutral sulphite semi-chemical process, sodium sulphite is used buffered with sodium carbonate.
(vi) Lignin is an inorganic binder.
(vii) Paper consumption in Pakistan is around 5kg per person per year.
(viii) Urea contains 90% nitrogen.
(ix) The temperature of the digester in paper industry should be around 160-180° C.
(x) Potassium fertilizers increase the capability of plants to resist diseases.

Answer Key.

(i)	True	(ii)	False	(iii)	True	(iv)	False	(v)	True
(vi)	False	(vii)	True	(viii)	False	(ix)	True	(x)	True

Q.3 Multiple choice questions. Encircle the correct answer.

(i) Which three elements are needed for the healthy growth of plants.
(a) N,S,P (b) N,Ca,P (c) N,P,K (d) N,K,C

(ii) Which woody raw material is used for the manufacture of paper pulp.
(a) Cotton (b) Bagasse (c) Poplar (d) Rice straw

(iii) The nitrogen present in some fertilizers helps plants.
(a) To fight against diseases (b) To produce fat
(c) To undergo photosynthesis (d) To produce protein

(iv) Phosphorus helps in the growth of.
(a) root (b) leave (c) stem (d) seed

(v) Micro-nutrients are required in quantity ranging from.
(a) 4-40g (b) 6-200g (c) 6-200kg (d) 4-40kg

(vi) During the manufacturing process of cement the temperature of the decomposition zone goes up to
(a) 600°C (b) 800°C (c) 1000°C (d) 1200°C

(vii) The word paper is derived from the name of which reedy plant.
(a) Rose (b) Sun flower (c) Papyrus (d) Water Hyacinth

(viii) Which is not a calcarious material.
(a) lime (b) clay (c) marble (d) marine shell

(ix) How many zones through which the charge passes in a rotary kiln.
(a) 4 (b) 3 (c) 2 (d) 5

(x) Ammonium nitrate fertilizer is not used for which crop.
(a) Cotton (b) Wheat (c) Sugar care (d) Paddy rice

Solved Exercise MCQ's

Q. No	Answer	Reason
(i)	(c) N, P, K	N = Nitrogen, P = Phosphorus, K = Potassium
(ii)	(c) Poplar	Cotton, bagasse and rice straw are non-woody raw materials.
(iii)	(d) To produce Protein	Nitrogen is main constituent of protein.
(iv)	(d) Seed	Phosphorus stimulates early growth and accelerates seed formation.
(v)	(d) 6 – 200g	Micro-nutrients are required in less amount.
(vi)	(b) 800°C	According to new text book in decomposition zone the temperature goes upto 900°C.
(vii)	(c) Papyrus	Papyrus grew along marshy delta of River Nile in Egypt.
(viii)	(b) Clay	Clay is argillaceous material.
(ix)	(a) 4	Each zone has a specific temperature.
(x)	(d) Paddy rice	Because microbial bacterial in flooded fields decompose ammonium nitrate to nitrogen.

Previous Boards MCQ's

1. Which substance is added to the air cooled cement clinker? (D.G Khan 2008)
(a) Clay (b) Gypsum (c) Alumina (d) Marble

2. The fertilizer, which contains 46 % N is (D.G Khan 2009)
(a) Urea (b) Ammonia (c) Ammonium nitrate (d) None

3. Argillaceous material used for the manufacture of cement provides (D.G Khan 2010)
(a) Basic components (b) Amphoteric components
(c) Acidic components (d) Both acidic and basic components

4. The natural fertilizer is called (Rwp 2008)
(a) Manure (b) Urea (c) Super phosphate (d) Ammonium sulphate

5. Which of the following elements is not a micro nutrient? (Rwp 2009)
(a) Cu (b) Fe (c) Mg (d) Mo

6. Macronutrients are required for acre in quantity ranging from (Rwp 2010)
(a) 2 – 200kg (b) 3 – 200 kg (c) 4 – 200kg (d) 5 – 200 kg

7. Ammonium nitrate fertilizer is not used for which crops? (Fsd 2009)
(a) Cotton (b) Wheat (c) Sugercane (d) Paddy rice

8. The number of zones through which the charge passes' in a- rotary kiln during manufacture of cement are
(a) 2 (b) 3 (c) 4 (d) 5

9. Phosphorus helps the growth of (Sgr 2009)
(a) Root (b) Leave (c) Stem (d) Seed

10. Micronutrients are required in quantity are ranging from (Sgr 2010)
(a) 4 - 40g (b) 6 - 200g (c) 6 - 200kg (d) 10 - 200kg

11. Which woody raw material is used for the manufacture of paper pulp? (Grw 2008)
(a) Cotton (b) Bagasse (c) Poplar (d) Rice straw

12. Which is not a calcareous material? (Grw 2009)
(a) Lime (b) Clay (c) Zymase (d) Lipase

13. The three elements needed for the healthy growth of plants are (Grw 2010)
(a) N, S, P (b) N, Ca, P (c) N, P, K (d) N, K, C

14. The nitrogen present in fertilizers helps plants (Fsd 12)(Lhr 2008)
(a) To fight against diseases (b) To produce fat
(c) To produce protein (d) To produce carbohydrates.

15. Which non-woody raw material is used for making pulp and paper (Lhr 2009)
(a) Fur (b) Corn straw (c) Eucalyptus (d) Poplar

16. The nitrogenous fertilizer easily taken up by plants is (Lhr 2011)
(a) Urea (b) Ammonium nitrate (c) Ammonia gas (d) Ammonia liquid

17. Percentage of nitrogen in urea is: (Lhr 12)
(a) 76% (b) 56% (c) 46% (d) 86%

18. The word paper is derived from the name of which reedy plant: (Lhr 12)
(a) Rose (b) Sun flower (c) Papyrus (d) Water Hyacinth

Bhatti Academy

Entry Test MCQ's

1. Ammonium carbamate on dehydration gives
(a) NH_3 gas (b) Urea (c) Ammonium bicarbonate (d) Water
2. Prilling of fertilizer increases its
(a) Solubility (b) Spreading power (c) Stability (d) Absorption
3. Which combination was first used as cement by Joseph Aspdin
(a) clay and sand (b) lime stone and clay (c) limestone and sand (d) soap stone and clay
4. The first paper was prepared by using Bark of
(a) Mulberry tree (b) Pine apple (c) Bamboo (d) Raspberry tree
5. Which of the three elements are largely needed for normal growth of crops
(a) N,P,K (b) H,P,S (c) N,P,C (d) N,C,Mg
6. Which of the following is not micronutrient
(a) Fe (b) H (c) Cu (d) Mn
7. The percentage of nitrogen in NH_3 is
(a) 82% (b) 16% (c) 46% (d) 33 – 33.5%
8. Which of the following process is alkaline
(a) Sulphite process (b) Neutral sulphite semi chemical process
(c) Kraft process (d) None of these
9. Which of the following makes paper brittle
(a) Lignin (b) Aand particles (c) Dust particles (d) Lump of clay
10. Which fertilizer is widely used in Pakistan
(a) $Ca(H_2PO_4)_2$ (b) $(NH_2)_2CO$ (c) KNO_3 (d) $(NH_4)_2HPO_4$
11. Which of the following fertilize contains 75% plant nutrients
(a) Urea (b) Super phosphate (c) DAP (d) NH_4NO_3
12. Which of the following paper bleaching agents is largely used in Pakistan
(a) Cl_2 (b) O_2 (c) O_3 (d) ClO_2
13. Which of the following is not common domestic materials which are recycled
(a) Paper (b) Plastics (c) Iron (d) Glass
14. In cement, lime is provided by heating
(a) $Ca(OH)_2$ (b) $CaSO_4$ (c) $CaCO_3$ (d) Clay
15. Micro-nutrients are required in quantity ranging from
(a) 4-40g (b) 6-200kg (c) 6-200g (d) 4-40kg

Additional MCQ's

1. CO_2 and liquid ammonia are mixed for the preparation of_____:
(a) Anhydrous ammonia (b) Ammonium carbamate (c) Molten ammonia (d) None of these
2. Ammonium nitrate (NH_4NO_3) is prepared by the.....:
(a) Acid base reaction (b) Neutralization reaction
(c) Dehydration reaction (d) Hydration reaction

3. Ammonium nitrate Contains .....:
(a) 33-35 % Nitrogen (b) 33-37% NH_3 (c) 33-37 % Nitrogen (d) All of these
4. Ammonium nitrate is_____in nature
(a) Acidic (b) Basic (c) Hygroscopic (d) Neutral
5. In fomation of $(NH_4)_2HPO_4$, pH is maintained at:
(a) 4-6 (b) 5.8-6.0 (c) 7 (d) 11
6. Potassium fertilizers are especially used for:
(a) Imparting green colour to leaves (b) Accelerate seed development
(c) Tobacco & corn (d) All of these
7. In wet process grinding is done in presence of.
(a) Steam (b) Water (c) NaOH (d) All
8. Hydrated tricalcium aluminate react with gypsum to form:
(a) Tricalcium silicate (b) Aluminium hydroxide (c) Calcium hydroxide (d) Calcium sulpho-aluminate
9. During setting of cement which compound form needle shaped crystals:
(a) Aluminium hydroxide (b) Tricalcium aluminate
(c) Calcium hydroxide (d) Tricalcium silicate
10. In NSSC which compound is used as cooking liqour:
(a) Sodium sulphite (b) Potassium sulphite (c) Sodium hypochlorite (d) Hydrogen peroxide
11. pH in digester is maintained at:
(a) 4-5 (b) 6-7 (c) 7-8 (d) 7-9
12. Which one of the following is the macro-nutrient for plants:
(a) Boron (b) Nitrogen & calcium (c) Calcium (d) Nitrogen
13. The first step in stock preparation plant is:
(a) Cutting of pulp (b) Beating of fibre
(c) Dispersion of pulp (d) Addition of chemical additives
14. From wet sheet of paper water is separated from fibre by:
(a) Gravity (b) Suction (c) Pressing (d) All of the above
15. The first part of Fourdrinier's machine is:
(a) Flow spreader (b) Head box (c) Calender stock (d) Cutting part
16. The dried paper has_____ moisture:
(a) 0% (b) 2-4% (c) 4-6% (d) 6-8%
17. What is the function of head box in paper making machine?
(a) It reduces the thickness of paper (b) It dries the paper
(c) It discharges the pulp at screen of fourdrinier table (d) Web structure is consolidated
18. The pulp from blow tank is washed to remove:
(a) Grey liquor (b) Black liquor (c) Excess suater (d) Extra gases
19. The colour of pulp is due to:
(a) Cellulose (b) Fibres (c) Pectin (d) Lignin
20. _____ makes paper brittle:
(a) Cellulose (b) Fibres (c) Pectin (d) Lignin
21. Which substance is used to bleach the pulp :
(a) Sodium sulphite (b) Sodium hypochlorite (c) Sodium chloride (d) Sodium hydroxide
22. Which fertilizer has minimum percentage of nitrogen :
(a) Ammonia (82%) (b) Potassium nitrate (c) Ammonium nitrate (d) Urea

Bhatti Academy

23. Which one of the following fertilizers provide the nitrogen and phosphorous to plants:
(a) Urea (b) Calcium super phosphate
(c) Diammonium phosphate (d) Potassium nitrate

24. Which one of the following raw materials is not present in the cement:
(a) Limestone (b) Gypsum (c) Blast furnace slag (d) Red lead

25. Which f the following is required by the soil in large quantities?
(a) Nitrogen (b) Hydrogen (c) Both N and H (d) None of above

ANSWERS TO MCQ'S

Previous Board MCQ's

Q.No.	Answer	Reason
1.	(b) Gypsum	2% gypsum is added to prolong the time of setting.
2.	(a) Urea	$(NH_2)_2CO$, % of N = 28/60 × 100 = 46.67%
3.	(c) acidic components	Calcarious material provides basic components.
4.	(a) Manure	Manure is an organic material used to fertilize land.
5.	(c) Mg	N, P, K, Ca, Mg, S, C, H, O are macronutrients.
6.	(d) 5 – 200 kg	Macronutrients are required in high amount.
7.	(d) Paddyrice	Because microbial bacterial in flooded fields decompose ammonium nitrate to nitrogen.
8.	(c) 4	Each zone has a specific temperature.
9.	(d) seed	P stimulates early growth & accelerates seed formation.
10.	(b) 6 – 200g	Micronutrents are required in less amount.
11.	(b) Poplar	Cotton, bagasse and rice straw are non-woody.
12.	(b) Clay	Clay is not a calcarious material
13.	(c) N.P.K	N = Nitrogen, P = Phosphorus, K = Potassium
14.	(c) to produce protein	Nitrogen is an essential constituent of protein.
15.	(b) Corn straw	Fur, Eucalyptus and poplar are woody.
16.	(d) Ammonia liquid	Ammonia is used in liquid state and easily taken up by plants.
17.	(c) 46% urea = $(NH_2)_2$ CO	% of N = 28/60 × 100 = 46.67%
18.	(c) Papyrus	Papyrus grew abundantly along the marshy delta of River Nile in Egypt.

Entry Test MCQ's

Q. No	Answer	Reason
1.	(b) Urea	$NH_2-\overset{\overset{O}{\|}}{C}-O-NH_4 \xrightarrow{\Delta} NH_2-\overset{\overset{O}{\|}}{C}-NH_2 + H_2O$
2.	(b) Spreading power	As it becomes easy to spread the fertilizer in form of prills.
3.	(b) limestone and clay	Joseph Aspdin was an English Mason.
4.	(a) Mulberry tree	First paper was prepared by Ts'ai Lun of China.
5.	(a) N, P, K	N = Nitrogen, P = Phosphorus, K = Potassium
6.	(b) H	Micro – nutrients are B, Cu, Fe, Mn, Zn, Mo, Cl.
7.	(a) 82%	% of N = 14/17 × 100 = 82.35%
8.	(c) Kraft Process	Kraft process is principal method of chemical pulping.

9.	(a) Lignin	Lignin is an aromatic polymer.
10.	(b) $(NH_2)_2CO$	$(NH_2)_2$ CO is urea which is widely used in Pakistan because it is the most concentrated solid nitrogen fertilizer.
11.	(c) DAP	(DAP Diammonium Phosphate) contains 16% N and 48% P_2O_5 = 75% nutrients.
12.	(d) ClO_2	ClO_2 is chlorine dioxide
13.	(d) Glass	Glass is highly brittle and cannot be recycled.
14.	(c) $CaCO_3$	$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$
15.	(c) 6 – 200g	Micro nutrients are required in less quantity.

Additional MCQ's

Q. No	Answer	Reason
1.	(b) Ammonium carbonate	$CO_{2(g)} + 2NH_{3(g)} \longrightarrow NH_2-\overset{\overset{O}{\|}}{C}-O-NH_4$
2.	(b) Neutralization reaction	$NH_{3(g)} + HNO_{3(g)} \longrightarrow NH_4NO_{3(s)}$ NH_3 is base and HNO_3 is an acid.
3.	(a) 33 – 35% nitrogen	% age of N = 28/80 x 100 = 35%
4.	(c) Hygroscopic	Ammonium nitrate is an important fertilizer.
5.	(b) 5.8 = 6.0	The reaction between NH_3 & H_3PO_4 is neutralization.
6.	(c) Tobacco and Corn	Potassium is necessary for both these crops.
7.	(b) Water	Grinding, in the presence of H_2O is done in tube mills.
8.	(d) Calcium sulpho-aluminate	It is $3CaO.Al_2O_3.3CaSO_4.2H_2O$
9.	(c) Calcium Hydroxide	These needle shaped crystals get studded in colloidal gel and imparts strength to it.
10.	(a) Sodium sulphite	Sodium sulphite cooking liquor is buffered with NaOH.
11.	(d) 7 – 9	For this purpose sodium sulphite is buffered with NaOH or Na_2CO_3.
12.	(b) Nitrogen and calcium	Boron is micronutrient.
13.	(c) Dispersion of pulp.	One of three important stages in stock preparation plant is the dispersion of the pulp as a slurry in water.
14.	(d) All of these	All of these are done in dryer section of paper making machine.
15.	(a) Flow spreader	It takes pulp and distribute it evenly across the machine.
16.	(d) 6 – 8%	The dried paper is wound in the form of a reel having final moisture of about 6 – 8 %.
17.	(c) It discharges the pulp at screen of fourdrinier table	Head box is pressurized where special suction devices work for the removal of water.
18.	(b) Black liquor	It should remove because it contaminates the pulp.
19.	(d) Lignin	Lignin is an aromatic polymer.
20.	(d) Lignin	Lignin is an aromatic polymer.
21.	(Sodium hypochlorite	It is used to bleach pulp due to its oxidative nature.
22.	(b) Potassium nitrate	% of N = 14/101 × 100 = 13.86 % which is less than others.
23.	(c) Diammonium phosphate	16% N and 48% P_2O_5.
24.	(d) Red lead	Red lead has no connection with cement.
25.	(c) Both N and H	Macronutrients are N, P, K, Ca, Mg, H, C, O, S.

Khalid Mahmood

Short Answers Questions

1. What are fertilizers? Why are they needed? (Fsd 09, Mtn 12)

Ans. Fertilizers

"The substances which are added to the soil to make up the deficiency of essential elements like nitrogen, phosphorus and potassium (NPK) required for the proper growth of plants are called fertilizers."

Examples: Urea, KNO_3, manure, NH_3, $(NH_4)_2 HPO_4$ etc.

Need of Fertilizers:

Fertilizers enhance the natural fertility of the soil or replenish the chemical elements taken up from soil by the previous crops.

2. Classify the elements essential for plant growth. (Lhr 12, Lhr 11)

Ans. Classification of Elements Essential for Plant Growth

Plants need nutrients from the soil for a healthy growth. The elements essential for the plant growth can be classified into following two classes.

Micronutrients	Macronutrients
○ The nutrients which are required in a very small amount for the growth of plants are called micro-nutrients.	○ The nutrients which are required in a very large amount for the growth of plants are called macro-nutrients.
○ These include B, Cu, Fe, Mn, Zn, Mo and Chlorine	○ These include N, P, K, Ca, Mg, S, C, H and O
○ These are generally required in quantities ranging from 6g to 200g per acre.	○ These are generally required in quantities ranging from 5kg to 200 kg per acre.

3. What are macro nutrients? Give their names. (Fsd 08)

Ans. Macro-nutrients

"The nutrients which are required in a very large amount for the growth of plants are called macro-nutrients."

- These includes N, P, K, Ca, Mg, S, C, H and O.
- These are generally required in quantities ranging from 5kg to 200 kg per acre.

4. What are micro nutrients? Give its uses. (Rwp 09)

Ans. Micro-nutrients

"The nutrients which are required in a very small amount for the growth of plants are called micro-nutrients."

- These includes B, Cu, Fe, Mn, Zn, Mo and Chlorine.
- These are generally required in quantities ranging from 6g to 200g per acre.

5. Write down any four characteristic features for a good fertilizer. (Lhr 12)

Ans. Features for a good fertilizer

The essential requisites of a good fertilizer are:

(i) It must be fairly soluble in water so that it thoroughly mixes with the soil.
(ii) It should not be injurious to plant.
(iii) It should be cheap.
(iv) It should not alter the pH of the soil.

6. Write names and formulas of any two nitrogenous fertilizers. (Fsd 10, Sgr 09)

Ans. Nitrogenous Fertilizers

(i) Ammonium sulphate $(NH_4)_2SO_4$
(ii) Urea $(NH_2)_2CO$

7. Ammonia acts as fertilizer. Comment (D.G Khan 10)

Ans. Ammonia (NH_3) as a Fertilizer

Ammonia is used in liquid state while all other nitrogen fertilizers are used in the solid form. Anhydrous ammonia has become an important fertilizer for direct application to soil. Ammonia contains 82% nitrogen and it is injected about 6 inches under the surface of the soil, to avoid it from seeping out.

8. Enlist steps involved in the manufacturing of urea. (Lhr 12, Lhr 11)

Ans. Steps Involved in the manufacturing of urea

Urea is produced by the reaction of liquid ammonia with gaseous carbon dioxide. Following steps are involved in the manufacture of urea.

(i) Preparation of Hydrogen
(ii) Preparation of Ammonia
(iii) Preparation of Ammonium Carbamate
(iv) Preparatin of Urea
(v) Concentration of Urea
(vi) Prilling

9. Write equation for preparation of:
(a) Ammonium carbamate from ammonia.
(b) Urea from ammonium carbamate.

Ans. **(a) Ammonium carbamate from ammonia**

Gaseous CO_2 is mixed with ammonia in the volume ratio of 1:2 in a reactor to produce ammonium carbamate.

$$CO_{2(g)} + 2NH_{3(g)} \longrightarrow NH_2-\overset{\overset{O}{\|}}{C}-O-NH_4$$

Ammonium Carbamate

(b) Urea from ammonium carbamate

Dehydration of ammonium carbamate gives urea.

$$NH_2-\overset{\overset{O}{\|}}{C}-O-NH_4 \xrightarrow{\Delta} NH_2-\overset{\overset{O}{\|}}{C}-NH_2 + H_2O$$

Urea

10. Ammonium nitrate is a useful fertilizer for many crops except paddy rice, why? (Grw 11)

Ans. It is a useful fertilizer for many crops except paddy rice because the microbial bacteria in flooded fields decompose it to nitrogen gas.

11. How will you prepare diammonium phosphate from ammonia? Also indicate the percentage of N_2 and P_2O_5 present in this fertilizer. (Lhr 09, 11, Grw 10)

Ans. Preparation of Diammonium Phosphate $(NH_4)_2HPO_4$

Anhydrous ammonia gas is reacted with pure phosphoric acid to prepare diammonium phosphate by a continuous process at 60 – 70°C and pH 5.8 to 6.

$$2NH_{3(g)} + H_3PO_{4(l)} \longrightarrow (NH_4)_2 HPO_4 + Heat$$

It contains 16% nitrogen and 48% P_2O_5.

12. What is the role of phosphorus in plant growth? Give names of some phosphorus fertilizers? (D.G khan 09)

Ans. Role of Phosphorus in Plant Growth

(i) Phosphorus is required to stimulate early growth, to accelerate the seed and fruit formation during the later stages of growth.

bhattiacademy

(ii) It also increases the resistance to diseases.

Phosphatic fertilizers

The two most important water soluble fertilizers are
(i) Super phosphate (calcium super phosphate) $Ca(H_2PO_4)_2$
(ii) Triple phosphate (diammonium-phosphate) $(NH_4)_2HPO_4$

13. What is the importance of potassium fertilizer? (D.G Khan 08)

Ans. Importance of Potassium Fertilizers in plant growth

Potassium fertilizers such as KNO_3 has following role in plant growth
(i) Potassium is required for the formation of starch, sugar and the fibrous material of the plant.
(ii) They increase resistance to diseases and make the plants strong by helping in healthy root development.
(iii) They also help in ripening of seeds, fruits and cereals.
(iv) Potassium fertilizers are especially useful for tobacco, coffee, potato and corn.

14. What is the composition of lime, silica, alumina and magnesium oxide in a good cement? (Mtn 12, Lhr 08)
Or Describe the composition of a good cement.

Ans. Composition of a Good Cement

Compound	% age
Lime (CaO)	62
Silica (SiO_2)	22
Alumina (Al_2O_3)	7.5
Magnesia (MgO)	2.5
Iron oxide (Fe_2O_3)	2.5
Sulphur trioxide (SO_3)	1.5
Sodium oxide (Na_2O)	1.0
Potassium oxide (K_2O)	1.0

15. Name four argillaceous materials used for the manufacturing of cement. (Grw 11)

Ans. Argillaceous material

Following Argillaceous materials are used for the manufacturing of cement:
(i) clay (ii) shale (iii) slate (iv) blast furnace slag
They provide acidic components such as aluminates and silicates.

16. What is the function of argillaceous materials in cement?

Ans. Function of Argillaceous material in Cement

Argillaceous material (clay, shale, slate, blast furnace slag) provides acidic components such as aluminates and silicates.

17. What do you know about decomposition zone of rotary kiln? (Grw 09, Lhr 08)

Ans. Decomposition Zone (Moderate temperature zone)

In the rotary kiln, the charge passes through the different zones of temperature where different reactions take place. The charge takes 2 – 3 hours to complete the journey in the kiln.

In decomposition zone, the temperature goes upto 900°C. In this zone the limestone ($CaCO_3$) decomposes into lime (CaO) and CO_2.

$$CaCO_{3(s)} \xrightarrow{900^\circ C} CaO_{(s)} + CO_{2(g)}$$

18. What do you mean by setting of cement? (Rwp 08)

Ans. Setting of Cement

"Cement paste when combines with water and allowed to stand for sometime then the resulting mass becomes hard and very resistant to pressure. This process is known as setting of cement."

The use of cement in the construction of building is based on its property of setting to a hard mass.

19. Describe the reactions taking place during setting of cement in first 24 hours. (Sgr 09, Fsd 10, Grw 09)

Ans. Reactions Taking Place in First 24 Hours

A short time after the cement is mixed with water, tricalcium aluminate absorbs water (hydration) and forms a colloidal gel of the composition, $3Ca.\ Al_2O_3.\ 6H_2O$ (hydrated tri calcium aluminate).

This gel starts crystallizing slowly, reacts with gypsum ($CaSO_4.\ 2H_2O$) to form the crystals of calcium sulpho-alumiate ($3CaO.\ Al_2O_3.\ 3CaSO_4.\ 2H_2O$).

20. What reactions takes place in the setting of cement from one to seven days? (Fsd 12)

Ans. Reactions Taking Place Between 1 to 7 Days

- Tri–calcium silicate ($3CaO.SiO_2$) and tricalcium aluminate ($3CaO.\ Al_2O_3$) get hydrolyzed to produce calcium hydroxide and aluminium hydroxide.
- The calcium hydroxide, thus formed, starts changing into needle-shaped crystals, which get studded in the colloidal gel and impart strength to it.
- Alumimin hydroxide, on the other hand, fills the interstices resulting in hardening the mass. The gel formed starts losing water partly by evaporation and sets to a hard mass.

21. Define paper. Give important raw material for the manufacture of paper. (Fsd 12)

Ans. Paper

"A sheet material made up of a network of natural cellulosic fibres which have been deposited from an aqueous suspension is called paper." The product obtained is a network of interwinning (interlocking) fibres.

Raw Material

The main raw materials used in the production of pulp and paper in Pakistan is of two types, that is non-woody and woody raw materials.

Non-Woody Raw Materials				Woody Raw Materials	
(i)	Wheat straw	(vi)	Cotton stalk	(i)	Poplar (hard wood)
(ii)	Rice straw	(vii)	Cotton linter	(ii)	Eucalyptus (hard wood)
(iii)	Bagasse	(viii)	Kahi grass	(iii)	Douglas fir (soft wood)
(iv)	Bamboo	(ix)	Grasses		
(v)	Rag				

22. What are the four non-woody raw materials used in the production of paper? (Grw 09)

Ans. Non-Woody Raw Materials

(i) Wheat straw (ii) Cotton stalk
(iii) Rice straw (ii) Rag

23. What are the principal methods of chemical pulping used for the production of paper? Which one is best and why?

Ans. Pulping processes

The following are three principal methods of chemical pulping and are used for the production of paper pulps.
(i). Kraft process (Alkaline)
(ii). Sulphite process (Acidic)
(iii). Neutral Sulphite Semi Chemical process (NSSC)

Best Method of Chemical Pulping

The neutral sulphite semi chemical process has come to occupy the dominant position because of the advantages in chemical recovery and pulp strength.

Bratt Academy

24. What do you mean by dry cleaning in paper manufacture? (Rwp 08)

Ans. **Dry Cleaning**

Wheat straw is collected from the storage and is then sent for dry cleaning. For this purpose air is blown into the raw material, which removes unwanted particles.

25. Pulp formed by digestion is washed at pulp washing stage. Why is it essential? (Grw 11)

Ans. **Pulp washing:**

The cooked material from the blow tank is washed thoroughly with water using 80 mesh sieve to remove the black liquor that would contaminate the pulp during subsequent processing steps. The pulp is washed with required amount of water to remove soluble lignin and coloured compounds. Lignin is an aromatic polymer and causes paper to become brittle. It is then thickened and finally stored in high-density storage tower.

26. What is digestor in paper industry? Which type of process is used in paper manufacture in our country? (Sgr 09)

Ans. The digestor is usually 10 meters in length and 2 meters in diameter. It is made of steel and wrought iron.
The digestion process is of two types:
(a) Bath process
(b) Continuous process
In our country batch process is mostly used.

27. Name commonly used bleaching agents in paper manufacture. (Grw 12, Sgr 10, Rwp 10)

Ans. **Common Bleaching Agents Used in Pakistan**

In Pakistan, bleaching is done with
(i) Chlorine (Cl_2) (ii) Sodium hypochlorite (NaClO)
(iii) Hydrogen peroxide (H_2O_2)

28. Write four components of paper making machine. (D.G Khan 09)

Ans. **Components of Paper Making Machine**

(i) Flow Spreader (ii) Head Box
(iii) Fourdrinier Table (iv) Press Section

29. How paper industry can be more progressive in Pakistan? How much paper is consumed annually in our country? (Lhr 10)

Ans. To make our country self-sufficient in this important commodity, we must utilize every source of raw material like non-woody and woody. Fortunately, Pakistan has enough source of non-woody material, which in future can meet the requirements of our pulp and paper industry. The efforts are being made to install more pulp and paper industries in the country.

At present there are more than 30 pulp and paper industries in private as well as in public sectors, which are manufacturing pulp and paperboard.

Due to high prices of paper in Pakistan, it's per head consumption is among the lowest in the world. Paper consumption in Pakistan is around 5 kg per person per year.

****

CHAPTER 16

ENVIRONMENTAL CHEMISTRY

Solved Objective Exercise

Q1. Fill in the blanks.

(i) Only ____ of the total earth's water resources are available as fresh water.
(ii) ____ is a smaller unit of biosphere which consists of community of organisms and their interaction with environment.
(iii) Carbon monoxide is highly poisonous gas and causes suffocation if inhaled, it binds blood____ more strongly than oxygen thus excluding oxygen from normal respiration.
(iv) The elevated concentration of ____ is harmful for fish as it clogs the gills thus causing suffocation.
(v) The ozone layer in ____surrounds the globe and filters most of the harmful UV rays in the sunlight before they could reach the earth.
(vi) The presence of ____ in livestock waste can contaminate surface and ground water causing various infectious diseases.
(vii) The substances which can directly kill the unwanted organisms are called ____.
(viii) ____ is frequently used to disinfect water.
(ix) Incineration is not a clean process because it produces air pollution and toxic ____.
(x) A process in which some of the used or the waste materials are not discarded after their initial use but are processed so that they can be used again is called ____.

Answer Key.

(i)	1%	(ii)	Ecosystem
(iii)	Haemoglobin	(iv)	Aluminium
(v)	Stratosphere	(vi)	Chemical and bacterial contents
(vii)	Pesticides	(viii)	Chlorine
(ix)	Ash	(x)	Recycling

Q2. Indicate True or false.

(i) Half of the mass of the atmosphere is concentrated in lower 10 km.
(ii) The oceans cover approximately 71 percent of the earth.
(iii) The volcanoes produce 55% of SO_2.
(iv) The reducing smog is due to the presence of nitric oxide.
(v) Ozone is produced in the polar regions by the photochemical reaction of oxygen.
(vi) The temperature in the troposphere decreases with the increasing altitude from 15 to – 56° C.
(vii) Incineration is a waste treatment process in which solid waste is dumped in a land fill.
(viii) Acid rain is due to the presence of oxides of sulphur and nitrogen which get mixed with the rain water.
(ix) The heavy metals have a safe limit where they are not toxic.
(x) The reprocessing of the plastics is to convert back to their components by a chemical or thermal process so that these can be used again.

bhatti Academy

Answer Key.

(i)	False	(ii)	True	(iii)	False	(iv)	False	(v)	False
(vi)	True	(vii)	False	(viii)	True	(ix)	False	(x)	False

Q3. Multiple choice questions. Encircle the correct answer.

(i) The pH range of the acid rain is
(a) 7-6.5 (b) 6.5-6 (c) 6-5.6 (d) less than 5

(ii) Peroxyacetylnitrate (PAN) is an irritant to human beings and it affects.
(a) eyes (b) ears (c) stomach (d) nose

(iii) To avoid the formation of toxic compounds with chlorine which substance is used for disinfecting water.
(a) $KMnO_4$ (b) O_3 (c) Alums (d) Chloramines

(iv) A single chloride free radical can destroy how many ozone molecules
(a) 100 (b) 100000 (c) 10000 (d) 10

(v) Fungicides are the pesticides which
(a) control the growth of fungus (b) kill insects
(c) kill plants (d) kill herbs

(vi) Ecosystem is a smaller unit of
(a) lithosphere (b) hydrosphere (c) atmosphere (d) biosphere

(vii) The main pollutant of leather tanneries in the waste water is due the salt of :
(a) lead (b) chromium(VI) (c) copper (d) chromium(III)

(viii) In purification of potable water the coagulant used is
(a) nickel sulphate (b) copper sulphate (c) barium sulphate (d) alum

(ix) The temperature in the non-rotating chamber in the incineration of industrial and hazardous waste process has a range.
(a) 900 to 1000°C (b) 250 to 500°C (c) 950 to 1300°C (d) 500 to 900°C

(x) Newspaper can be recycled again and again by how many times.
(a) 2 (b) 3 (c) 4 (d) 5

Solved Exercise MCQ's

	Answer	Reason
(i)	(d) Less than 5.	The rain having pH less than 5 contains more acidic contents due to which it is acidic.
(ii)	(a) eyes	PAN is an oxidizing agent and is irritant to eyes.
(iii)	(b) O_3	Chlorine produces harmful compounds like chloramines, $CHCl_3$ but O_3 does not form such compounds.
(iv)	(b) 100000	Chloride free radical is very reactive so it can destroy 100000 O_3 molecules.
(v)	(a) Control the growth of fungus	Fungicide → fungi (fungus) + cide (to kill)
(vi)	(d) Biosphere	Ecosystem consists of community of organisms and their interaction with environment while biosphere consists of all regions of earth capable of supporting life.
(vii)	(b) Chromium (VI)	Chromium (VI) is highly toxic and is carcinogenic.
(viii)	(d) alum	Alum causes the precipitation of suspended impurities.
(ix)	(c) 950° to 1300°C	In this chamber organic molecules are completely destroyed.
(x)	(d) 5	In recycling process, the fibre of the newspaper becomes shorter so it can be recycled again and again for five times.

Previous Boards MCQ's

1. Ecosystem is a smaller unit of (D.G Khan 08, Grw 09, Fsd 08)
(a) Lithosphere (b) Hydrosphere (c) Atmosphere (d) Biosphere

2. The normal amount of overhead ozone is about (D.G Khan 08, Fsd 10)
(a) 150 DU (b) 250 DU (c) 350 DU (d) 450 DU

3. The decrease in ozone concentration in overhead atmosphere is occurring due to human activity. Half of the ozone over Antarctica has been depleted up to the year (D.G Khan 09)
(a) 1960 (b) 1970 (c) 1980 (d) 1999

4. Incineration is a process in which solid-waste is burnt at elevated temperature. Following temperature range is most effective (D.G Khan 09)
(a) 900 to 1000°C (b) 800 to 900°C (c) 100 to 200°C (d) none

5. Component of environment which consist of all water bodies is (D.G Khan 10)
(a) Biosphere (b) Hydrosphere (c) Lithosphere (d) Atmosphere

6. Reducing smog contains high contents of (D.G Khan 10)
(a) NO_2 (b) SO_2 (c) NO (d) CO_2

7. Biochemical oxygen demand is the capacity of organic matter in natural water to consume oxygen with in a period of (Rwp 08)
(a) Three days (b) Four days (c) Five days (d) Six days

8. Half of the mass of atmosphere is concentrated in lower (Rwp 09)
(a) 4.6 km (b) 5.6 km (c) 3.6 km (d) 15 km

9. Lithosphere extends in earth up to the depth of (Rwp 09)
(a) 50 km (b) 100 km (c) 150 km (d) 30 km

10. Peroxy acetyl nitrate (PAN) is an irritant to human being and it effects (Rwp 10, Srg 10, Lhr 08, 09)
(a) Ears (b) Stomach (c) Eyes (d) Nose

11. The main pollutant of leather tanneries in the waste water is due to the salt of (Fsd 09)
(a) Lead (b) Chromium III (c) Copper (d) Chromium VI

12. Fungicides are the pesticides which (Fsd 09, Srg 10)
(a) Control the growth of fungus (b) Kill insects (c) Kill plants (d) Kill herbs

13. The mass of the lithosphere is made of (Sgr 09, Grw 10, Lhr 09, 10)
(a) 9 elements (b) 10 elements (c) 11 elements (d) 12 elements

14. The pH range of the acid rain is (Sgr 10)
(a) 7 - 6.5 (b) 6.5 – 6 (c) 6 - 5.6 (d) Less than 5

15. The residence time of NO in atmosphere is (Grw 08)
(a) Thirty minutes (b) One day (c) Three days (d) Four days

16. Which gas is not a pollutant? (Grw 09)
(a) SO_2 (b) CO (c) NO_2 (d) CO_2

17. The thickness of atmosphere is (Grw 10, 11)
(a) 1500 km (b) 1000 km (c) 500 km (d) 100 km

18. Newspaper can be recycled again and again by how many times? (Lhr 10)
(a) 2 (b) 3 (c) 5 (d) 6

19. A single chloride free radical can destroy how many ozones molecules (Lhr 11)
(a) 100 (b) 100.000 (c) 10.000 (d) 10

20. Following is better to disinfect water
(a) Cl_2 (b) O_2 (c) O_3 (d) $KMnO_4$

21. The residual ash after incineration of industrial waste is disposed off in a landfill, which is lined with
(a) Portland cement (b) Clay and plastic (c) Methyl silicone (d) Stone-ware

Entry Test MCQ's

1. Biosphere includes
(a) Hydrosphere only (b) Atmosphere only (c) Lithosphere only (d) All of these
2. Which one is not a chemical pollutant?
(a) Noise (b) Liquid wastes (c) Pesticides (d) Solid wastes
3. Which is not an air pollutant?
(a) H_2 (b) SO_2 (c) H_2S (d) O_3
4. Which one is not a correct statement?
(a) Primary pollutants are those which are emitted directly from the source
(b) Secondary pollutants are those which are formed in the atmosphere by chemical interactions among primary pollutants and atmospheric constituents
(c) Acid-rain is a primary pollutant
(d) None of these
5. If BOD of a river is high, it means that the river is
(a) Not polluted (b) Very much polluted with inorganic chemicals
(c) Very much polluted with organic chemicals (d) Polluted with pesticides
6. Which of the following is produced by reaction of ultraviolet light?
(a) CO (b) O_2 (c) SO_2 (d) NO_2
7. Photo-chemical oxidants such as PAN or PBN are formed by
(a) Action of nitrogen oxides on hydrocarbons in the presence of sunlight
(b) Action of carbon dioxide on hydrocarbons in the presence of sunlight
(c) Action of hydrogen sulphide on hydrocarbon in the presence of sunlight
(d) None of these
8. The normal amount of overhead ozone is about
(a) 300DU (b) 350Du (c) 400DU (d) 550DU
9. The chief pollutants which are responsible for ozone depletion
(a) SO_2 (b) CO (c) CO_2 (d) Chlorofluorocarbons
10. SO_2 and NO_2 cause pollution by increasing
(a) Acidity (b) Buffer action (c) Alkalinity (d) Neutrality
11. Which of the following is the secondary pollutant?
(a) CO (b) SO_2 (c) PAN (d) Aerosol
12. Ozone hole refers to
(a) Increased concentration of ozone
(b) Reduction in the thickness of ozone layer in troposphere
(c) Reduction in the thickness of ozone layer in stratosphere
(d) Hole in ozone layer
13. Photochemical smog is related to the pollution of
(a) Soil (b) Noise (c) Water (d) Air
14. $CFCl_3$ is responsible for the decomposition of ozone to form oxygen. Which of the following reacts with ozone to form oxygen?
(a) Cl_2 (b) F^- (c) Cl^- (d) $Cl^\bullet$
15. In which part of atmosphere, ozone layer is present?
(a) Stratosphere (b) Mesosphere (c) Troposphere (d) Thermosphere

16. The major source of CO pollution is:
(a) Exhaust from automobiles (b) Volcanic eruptions (c) Forest fires (d) Industrial process
17. Which of the following air pollutants is quiet killer
(a) NO_2 (b) CO (c) CO_2 (d) NO
18. Which method is used to remove permanent hardness of water
(a) Ion exchange method (b) Aeration (c) Coagulation (d) Chlorination
19. Peroxyacetylnitrate (PAN) is an irritant to human beings and it affects
(a) Nose (b) Eyes (c) Ears (d) Stomach
20. Which of the following is not common domestic materials which are recycled
(a) Paper (b) Plastics (c) Iron (d) Glass
21. Incineration is not a clean process because it produces toxic
(a) Liquids (b) Effluents (c) Solids (d) Gases
22. The pH range of the acid rain is
(a) 7-6.5 (b) 6-5.6 (c) 6.5-6 (d) less than 5
23. Fungicides are the pesticides which
(a) Control the growth of fungus (b) Kill plants
(c) Kill insects (d) Kill herbs
24. The main pollutant of leather tanneries in the waste water is due to the salt of
(a) Lead (b) Copper (c) Chromium (VI) (d) Chromium (III)

Additional MCQ's

1. Which method is used for the disposal of solid waste :
(a) Landfill (b) Dumping (c) Incineration (d) All of these
2. Which process is not used to improve the quality of water:
(a) Aeration (b) Coagulation (c) Dumping (d) Chlorination
3. Amount of ozone is less in the region :
(a) North polar region (b) Equator (c) South polar region (d) Antarctic region
4. Which of the following component of air may not be pollutant:
(a) Carbon monoxide (b) Sulphur dioxide (c) Carbon dioxide (d) Nitric oxide
5. Which of the following compound is formed when HOCl reacts with humic acid dissolved in water:
(a) Chloramine (b) Chlorinated phenol (c) Chloroform (d) Carbon tetrachloride
6. The amount of oxygen in lithosphere is about:
(a) 35.50% (b) 40.60% (c) 46.60% (d) 50.50%
7. Ozone in most of the tropical regions acts as a pollutant and causes:
(a) Damages eyes (b) Aggravates asthma (c) Chest discomfort (d) All of these
8. The stratosphere where the ozone layer exists in the atmosphere is approximately at ..... kilometers altitude:
(a) 10-15 (b) 10-20 (c) 20-30 (d) 15-40
9. The toxic organic compounds and heavy metals and metalloids results in contamination of :
(a) Surface water (b) Ground water
(c) Both surface and ground water (d) Neither surface nor ground water
10. The dissolved oxygen value..... indicates that water is polluted:
(a) Less than 4 ppm (b) Greater than 4 ppm (c) Less than 5 ppm (d) Equal to 5 ppm
11. In purification of potable water, the coagulant used is:
(a) Nickel sulphate (b) Copper sulphate (c) Barium sulphate (d) Alum

bhattiAcademy

12. Which part of atmosphere is near to the earth:
(a) Thermosphere (b) Mesosphere (c) Stratosphere (d) Troposphere

13. Colloidal material in raw water is removed by:
(a) Heating (b) Coagulation (c) Chlorination (d) Combustion

14. How much fresh water is used for domestic purpose:
(a) 8% (b) 23% (c) 69% (d) 100%

15. COD of water can be determined directly by:
(a) Cr_2O_3 (b) CrO_4^{2-} (c) Cr (d) $Cr_2O_7^{-2}$

16. Which one of the following substances cause acid rain?
(a) SO_2 (b) Hydrocarbons (c) Chlorofluorocarbons (d) O_3

17. The combination of smoke and fog is called:
(a) Primary pollutant (b) Secondary pollutant (c) Smog (d) Coagulation

18. The yellowish colour in photochemical smog is due to the presence of:
(a) NO (b) NO_2 (c) SO_2 (d) CO_2

19. When sea water is aerated, which quality of water is improved?
(a) Foul smell gases are removed (b) Dissolved molecular oxygen increases
(c) Some organic matter and Fe^{2+} ions are oxidized (d) All of these

20. Which process is not involved to improve the qualities of raw water?
(a) Coagulation (b) Chlorination (c) Self-oxidation reduction (d) Aeration

21. The quality of raw-water is improved when it is chlorinated because:
(a) Cl_2 kills the pathogenic bacteria (b) Dissolved oxygen increases
(c) Hardness of water decreases (d) pH of water is controlled

ANSWERS TO MCQ'S

Previous Board MCQ's

Q.No.	Answer	Reason
1.	(d) Biosphere	Ecosystem consist of only community of organisms while biosphere contains all regions of earth supporting life.
2.	(c) 350 DU	DU is Dobson unit. Due to O_3 layer, harmful UV rays are absorbed.
3.	(c) 1980	The depletion starts from the mid 1970's to mid of 1980's.
4.	(a) 900 to 1000°C	In this process, all combustible materials burns and left behind only non-combustible materials.
5.	(b) Hydrosphere	Hydro – water, sphere – area
6.	(b) SO_2	SO_2 is chemically reducing in nature.
7.	(c) Five days	It is measured experimentally by calculating the concentration of oxygen at the beginning and at the end of five days period.
8.	(b) 5.6 km	This mass contains different gases e.g., N_2, O_2, Ar, CO_2, H_2 etc.
9.	(b) 100 km	99.5% mass of lithosphere is made of elements (O, Al, Si, Fe, Ca, Na, K, Mg, H_2, P)
10.	(c) eyes	PAN is an eye irritant and is also toxic to plants.
11.	(d) Chromium (VI)	Chromiom (VI) is highly toxic and is known to cause cancer.
12.	(a) Control Growth of fungus	Fungi – Fungus cide – to kill (killer).
13.	(c) 11 elements	They are oxygen, Si, Al, Fe, Ca, Na, K, Mg, Ti, H_2, P.
14.	(d) less than 5	Rain having pH less than 5 have more acidic contents so it is acidic.

15.	(d) Four days	NO causes acidic rain due to HNO_2 formation.
16.	(d) CO_2	As CO_2 is required for plants photosynthesis.
17.	(b) 1000 km	Atmosphere is layer of gases surrounding earth.
18.	(c) 5	The fibre of newspaper becomes shorter in recycling process so it can only be recycled 5 times.
19.	(b) 100,000	Chlorine Free Radical is very reactive so it can destroy 100,000 O_3 molecules.
20.	(c) O_3	Chlorine is not used because it produces harmful compounds while O_3 does not produce harmful compounds.
21.	(b) Clay and plastic	The lining of clay and plastic is used so that the leachate does not contaminate soil and ground water around.

Entry Test MCQ's

Q.No	Answer	Reason
1.	(d) All of these	Biosphere is the region of earth capable of supporting life.
2.	(a) Noise	It includes in air pollution. It has some physical effects.
3.	(a) H_2	Little concentration of H_2 is present in air.
4.	(c) Acid rain is primary pollutant	Acids (H_2SO_4 and HNO_3) which cause acid rain are formed through various reactions of SO_x and NO_x in aur.
5.	(c) very much polluted with organic chemicals	$BOD \propto \frac{1}{\text{Purity of water}}$
6.	(b) O_3	Ozone is produced by the photochemical reactions of O_2.
7.	(a) Action of nitrogen oxides. on hydrocarbons in the presence of sunlight	PAN is a component of photochemical smog.
8.	(b) 350DU	The amount of ozone in the atmosphere is expressed in Dobson Units (DU).
9.	(d) Chorofluorocarbons	When CFCs are subjected to UV, they generate Cl° free radicals which destroy ozone.
10.	(a) Acidity	SO_2 and NO_2 produced H_2SO_4 and HNO_3 respectively.
11.	(c) PAN	PAN is produced in air through various reactions.
12.	(c) Reduction in the thickness of ozone layer in stratosphere	The region on which ozone depletes substantially in every year during Sep – Nov is now termed as "ozone hole".
13.	(d) Air	Photochemical smog contains higher concentrations of oxidants.
14.	(d) Cl°	$Cl^\bullet + O_3 \longrightarrow ClO^\bullet + O_2$ $ClO^\bullet + O \longrightarrow Cl^\bullet + O_2$
15.	(a) Stratosphere	The ozone layer, 25 – 28 km high, exists in the stratosphere.
16.	(a) Exhaust from automobiles	Fuel burning in various types of transportation i.e., motor vehicles, railways and aircraft is the major source (75%) of carbon monoxide in the atmosphere.
17.	(b) CO	CO is highly poisonous gas and causes suffocation if inhaled since it is colourless and odourless, so it is called quiet killer.
18.	(a) Ion exchange method	Permanent hardness of water can be removed by ion exchange method and Clark's method.
19.	(b) Eyes	PAN is an eye irritant and is also toxic to plants.
20.	(c) Iron	The most common domestic materials that are recycled are paper, plastic,

Scanned with CamScanner

		glass and aluminium.
21.	(b) Effluents	It produces air pollution and also toxic ash.
22.	(d) Less than 5	Due to presence of acids like HNO_3 and H_2SO_4. pH of acid rain is less than 5.
23.	(a) Control the growth of fungus	∘ Fungicides (which control the growth of fungus of the plants). ∘ Insecticides (which kill insects) ∘ Herbicides (which kill undesired plants)
24.	(c) Chromium (VI)	Chromium (VI) is highly toxic and is known to cause cancer.

Additional MCQ's

Q. No	Answer	Reason
1.	(d) All of these	Land fill, dumping and incineration are used for disposal of solid waste.
2.	(a) Aeration	Air is passed through water the quality of water improves.
3.	(b) Equator	O_3 is formed in tropical regions and transported to polar regions but it is less in areas closer to equator.
4.	(c) Carbon Dioxide	CO_2 is not a pollutant as it is required for photosynthesis.
5.	(c) Chloroform	Chloroform is suspected liver carcinogen and also has negative reproduction and development effect in humans.
6.	(c) 46.60%	Oxygen is most abundant element in lithosphere.
7.	(d) All of these	Ozone is a pollutant and causes various health problems.
8.	(d) 15-40	Stratosphere is above troposphere which is 0-15 km from earth.
9.	(c) Both surface and ground water	Surface and ground water are vulnerable to contamination by these compounds.
10.	(a) less than 4ppm.	DO value is a parameter to determine the quality of water. (DO ∝ Purity of water)
11.	(d) Alum	When alum is added to water in alkaline medium, aluminium hydroxide is precipitated. Many suspended particles get adsorbed on the surface of gelatinous $Al(OH)_3$.
12.	(d) Troposphere	It is 0-15 km from earth.
13.	(b) Coagulation	Colloidal material forms ppt. with coagulant and many suspended paraticles get adsorbed with ppt.
14.	(a) 8%	For domestic purpose the required amount of water is less than its other uses.
15.	(d) $Cr_2O_7^{2-}$	It is an oxidizing agent. The organic matter in water is oxidized while remaining dichromate is determined by titremetrically.
16.	(a) SO_2	SO_2 forms H_2SO_4 with rain water causing acid rain.
17.	(c) Smog	Smog $\longrightarrow$ Smoke + fog $\longrightarrow$ Smog It causes various health problems. It is of two types.
18.	(b) NO_2	NO_2 is reddish brown gas so yellow colour of photochemical smog is due to the presence of NO_2.
19.	(d) All of these	Aeration improves the quality of water in all the three aspects.
20.	(c) Self oxidation reduction	Coagulation, Chlorination and Aeration are important methods to improve quality of water.
21.	(a) Cl_2 kills the pathogenic bacteria	Cl_2 is frequently used to disinfectant water. Cl_2 treatment is very effective in killing the pathogens.

Short Answers Questions

1. What is acid rain and how does it effect our environment? (Rwp. 07, Srg 09; Lhr 09, Grw 08,10)

Ans. Acid Rain

"The rain water having pH less than 5 is termed as acid rain".

Now a days acid rain is termed as "acid deposition". The acid deposition includes both wet (rain, snow, fog) and dry acidic deposition.

Causes of Acid rain:

The acid rain is due to oxides of sulphur (SO_2, SO_3) and oxides of nitrogen (NO, NO_2) which get mixed with rain water in the presence of pollutants to form sulphuric acid and nitric acid respectively.

$$4NO_2 + 2H_2O + O_2 \longrightarrow 4HNO_3$$

$$SO_2 + \frac{1}{2}O_2 + H_2O \xrightarrow{\text{Hydrocarbons, Smoke, metal oxides}} H_2SO_4$$

Effect of Acid Rain on Environment:

1. Acidification of the soil and rocks can leach metals like Al, Hg, Pb and Ca and discharges them into water bodies. These heavy metals are accumulated in the fishes and are health hazards for human and birds as they eat these fishes. The elevated concentration of Al is harmful for fish as it clogs the gills thus causing suffocation.
2. Acidification of the soil can also leach nutrients, thus damaging leaves and plants and also growth of forest.
3. It damages building materials such as steel, paint, plastic, cement, masonry work and sculptural materials especially of marble and limestone.

2. What is smog? Explain the pollutants which are the main cause of photochemical smog? (Fsd 09, Lhr 10)

Ans. Smog

"The word smog is a combination of smoke and fog".

It is formed from ground level upward to an altitude of few kilometers high.

Pollutants Causing Photochemical Smog.

- Due to having higher concentrations of oxidants like ozone, photochemical smog is also called **"oxidizing smog".**
- It is a yellowish brownish grey haze due to the presence of NO_2.
- It has unpleasant odour because of its gaseous components.

Reactants of Photochemical Smog.

(i) Nitric Oxide (NO) which main reactions of photochemical smog is oxidized to NO_2 within minutes to hours depending upon the concentration of pollutant gas.

(ii) Unburnt hydrocarbons.

3. What is ozone layer depleting? Write down harmful effects of ozone? (D.G Khan 10, Lhr 08)

Ans. Depletion of Ozone Layer

"The decrease in the thickness of the ozone layer due to the presence of certain chemicals produced by human activities is called depletion of ozone layer"

Ozone as a pollutant:

O_3 acts as a pollutant and causes:

(i) Health problems i.e., damages eyes and aggravates asthma, decreases the elasticity of lungs tissue, coughing chest discomfort.

(ii) It is harmful to the plants and other materials i.e., attacks rubber, reduces durability and appearance of paint and causes fabric dyes to fade.

Kinetic Academy

4. How is oil spillage affecting the marine life? (Rwp 10)

Ans. Effects of Oil Spillage

Petroleum or crude oil is a complex mixture of many compounds mainly hydrocarbons. Sea water gets polluted by accidental oil spills. Hydrocarbons particularly polycyclic aromatic are very dangerous even at very low concentrations. It is observed that spilled oil:

(i) Damages the marine life.

(ii) Effects the photosynthesis of plants.

5. How detergents are threat to aquatic animal life? (Fsd 08,09, Grw 09,10,11)

Ans. Detergents are used as cleaning agents in industries and at home. The waste water containing detergents when discharged in rivers or sea, greatly affects the aquatic life. Detergent contents of waste water mobilize the bound toxic ions of heavy metals such as Pb, Cd and Hg from sediments into water.

6. What are leachate?

Ans. Leachate

"The ground water which seeps in the landfill and liquid from the waste itself all percholate through the refuse is called leachate."

Composition of Leachate

The leachate contains;

(i) Volatile organic acids such as acetic acid and various fatty acids.

(ii) Microbial contaminents such as bacteria.

(iii) Heavy metals and salts of common inorganic ions such as Ca^{+2}.

(iv) Micropollutants such as toluene and dichloromethane.

7. What is Environmental Chemistry?

Ans. Environmental Chemistry

"The branch of chemistry which deals with the chemicals and other pollutants in the environment is called environmental chemistry."

In this we study the sources, reactions, transportation and effects of the pollutants on the environment.

8. What do you mean by Environmental pollutant?

Ans. Environmental Pollutant

"Any substance in the environment which adversely affects the human health, quality of life and the natural functioning of ecosystem is called environmental pollutant".

Examples:-

SO_3, NH_3, PAN, O_3, etc.

9. Write down primary and Secondary Pollutants OR What are different types of air pollutants? (D.G Khan 09, Lhr 09)

Ans. Primary Pollutants

"The pollutants which are directly mixed in the atmosphere are called primary pollutants".

- The primary pollutants are given out from chimneys of industrial units and exhaust of automobiles.

Examples

Sulphur dioxide (SO_2)	Sulphur trioxide (SO_3)	Nitrogen oxides (NO_x)
Carbon monoxide (CO)	Hydrocarbons	Ammonia (NH_3)
Compounds of Fluorine	Radioactive materials.	

Secondary Pollutants

"The pollutants which are produced by various reactions of primary pollutants in the atmosphere are called secondary pollutants".

- They are toxic and their concentration in the atmosphere must be controlled.

Examples:

Sulphuric Acid (H_2SO_4)	Nitrogen monoxide (NO)	Carbonic Acid (H_2CO_3)
Hydrofluoric Acid (HF)	Peroxyacetyl Nitrate (PAN) ($CH_3CO_3NO_2$)	Ozone (O_3)
Aldehydes (RCHO)	Ketones (RCOR)	Peroxybenzol ($C_6H_5CO_2$)

10. What are the effects of CO on human health? (Rwp 10)

Ans. Effects of CO on human health

(i) Carbon monoxide is highly poisonous gas and causes suffocation if inhaled. It binds blood haemoglobin more strongly than oxygen to form carboxy haemoglobin which is a stable compound.

$$Hb + CO \rightarrow Hb - CO$$

In this way, oxygen excludes from normal respiration.

(ii) High concentration of CO in blood results headache, fatigue, unconsciousness and eventually death. (if such exposure is sustained for longer period). CO is called quiet killer because of its colourless and odourless property.

11. Write down necessary conditions for the formation of Smog. (Lhr 10)

Ans. Conditions for the Formation of Smog

Following conditions are required for the formation of Smog.

(i) There must be sufficient NO, hydrocarbons and volatile organic compounds (VOC) emitted by the vehicular traffic.

(ii) There must be sunlight, so that some of the chemical reactions may occur at a rapid rate.

(iii) The movement of air mass must be little so that reactions are not disturbed.

12. Differentiate between Reducing Smog and Oxidizing Smog.

Ans.

Reducing Smog (Classical Smog)	Oxidizing Smog (Photochemical Smog)
It is formed due to the build up of sulphur dioxide from combustion of Coal.	It is formed due to photochemical reaction of sunlight on the nitrogen oxides and hydrocarbons produced by automobile and factories.
It involves smoke and fog.	It does not involve smoke and fog.
It mostly occurs in cool humid climate.	It occurs in warm, dry and sunny climate.
It has high concentration of SO_2 and is therefore reducing in character.	It has high concentraction of oxidants like O_3 and therefore is oxidizing in nature.
It causes bronchitis and irritation i.e. problem in lungs.	It causes irritation in eyes and toxic to plants.

13. What is Meant by Aeration?

Ans. Aeration

"The process in which air is passed through water to remove the dissolved gases such as foul smelling H_2S, organo sulphur compounds and volatile organic compounds."

In this process some of the organic material of the raw water can be easily oxidized with air and produce CO_2. The remaining portion of organic material if necessary is removed by passing water over activated carbon. Aeration process also oxidizes Fe^{+2} to Fe^{+3} which then forms insoluble Ferric hydroxide ($Fe(OH)_3$) and removed as solid.

Aeration also improves oxygen level of raw water.

bnatutes

14. What is Meant by Coagulation?

Ans. Coagulation

"The precipitation of the materials which are suspended or present in the colloidal form in a liquid by altering the surface characteristics of the solids is called coagulation".

Example:-

When Coagulant such as Alum is added to the raw water in the presence of $Ca(OH)_2$, the precipitate of aluminum hydroxide are formed. Many suspended particles get adsorbed on the Surface of gelatinous $Al(OH)_3$ precipitate.

$K_2SO_4.Al_2(SO_4)_3.\ 24H_2O + 3Ca(OH)_2 \longrightarrow 3CaSO_4 + 2Al(OH)_3 + K_2SO_4 + 24H_2O$

15. What is incineration. Give its advantages?

Ans. Incineration

"A waste treatment process in which solid waste is burned at high temperature ranging from 900-1000° C is called incineration."

Advantages of Incineration

i. The burning of the solid waste in the incinerator consumes all combustible material leaving behind the non-combustible material and the ash residues.
ii. It may reduce the volume of the waste by two-third.
iii. The combustible components of garbage provide fuel for the fire.
iv. In incineration the heat of combustion may used in producing steam which runs the turbine to produce electricity.

16. Why chlorination of water has harmful effects?

Ans. Harmful effects of chlorination

"The Chlorination of water has harmful effects due to its reaction with dissolved ammonia and organic matter present in water".

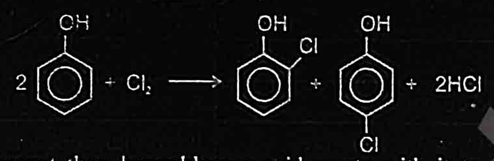
1- **Reaction with Ammonia**

For the chlorination of water, molecular chlorine is added in water which converts into HOCl. The Hypochlorous acid reacts with Ammonia to form chloramines NH_2Cl, $NHCl_2$ and especially nitrogen trichloride which is a powerful eye irritant

$$NH_3 + 3HOCl \rightarrow NCl_3 + 3H_2O$$

2- **Reaction with organic compounds**

i. If phenol is present in water then chlorinated phenols are formed which have offensive odour and taste and are toxic.



ii. If humic acid is present then hypochlorous acid reacts with it to form chloroform ($CHCl_3$) which is suspected liver carcinogen and also has negative reproduction and development effects in humans.

18. How formation of toxic compounds during the chlorination of water can be avoided?

Ans. The chlorination of water form different toxic organic compounds like chloramines (NH_2Cl, $NHCl_2$, NCl_3) chloroform ($CHCl_3$) and chlorinated phenols. The formation of these toxic compounds with chlorine can be avoided by using ozone or chlorine dioxide for the disinfection of water.

19. What is meant by Recycling of waste?

Ans. Recycling of waste

"The process in which some of the used or waste material are not discard after their initial use but are processed so that they can be used again is called Recycling".

The purpose of recycling is to conserve sources such as raw material and energy.

The most common domestic material that are recycled are paper, plastic, glass and Aluminium.

20. How recycling of plastics is done? What is reprocessing?

Ans. Recycling of plastics

The recycling of plastic is done by reprocessing, depolymeriztion or transformation.

Reprocessing:

"In reprocessing, the used plastics are remelted and used for the manufacturing of different products".

For example:

The original use of polystyrene is for the manufacturing of foam, packaging, cutlery, furniture etc. but after its reprocessing it is used mostly for manufacturing of toys, trays etc.

21. What is Depolymerization?

Ans. Depolymerization

"The process in which the used plastics are converted into their original components by a chemical or thermal process so that they can be subsequently polymerized again is called Depolymerization".

Example:

Polyethylene terephthalate can be thermally depolymerized in the presence of a catalyst and heat into its original components.

22. What is meant by Transformation?

Ans. Transformation

The transformation is a type of recycling of plastics. It can be defined as

"The process in which used plastics are converted into low quality substances which are later used for the production of other materials is called transformation."

For example:

The cracking of polyethylene at high temperature gives its monomers which are used for the manufacturing of lubricants.

23. What are the components of environment? (Rwp 09, Fsd 10)

Ans. Components of the Environment

The environment consists of the following components.

(i) Atmosphere (ii) Hydrosphere (iii) Lithosphere (iv) Biosphere

24. What is Lithosphere? Give its composition. (Sgd 09)

Ans. Lithosphere

"It consists of rigid rocky crust of earth and extends to the depth of 100 km."

The mantle and core are the heavy interior of the earth, making up most of the earth's mass.

The 99.5% mass of the lithosphere is made of **11 elements**, which are oxygen (~46.60%), Si (~27.72%), Al (8.13%), Fe (5.0%), Ca (3.63%), Na (2.83%), K (2.59%), Mg (2.09%), and Ti, H_2 and P (total less than 1%).

- The elements present in trace amounts (0.1 to 0.02%) are C, Mn, S, Ba, Cl, Cr, F, Zr, Ni, Sr and V.
- These elements mostly occur in the form of minerals.

25. What is difference between biosphere and ecosphere? (Fsd sup 10)

Ans. Biosphere

"Biosphere is the region of earth capable of supporting life."

It includes lower atmosphere, the oceans, rivers, lakes, soils and solid sediments that actively interchange materials with all types of living organisms *i.e.*, human beings, animals and plants.

Ecosphere

Ecosphere is a smaller unit of biosphere which consists of community of organisms and their interaction with environment e.g., animals, plants and microorganisms which lie in a definite zone and depend on the physical factors such as soil, water, and air.

Prattiacademy

26. What is the importance of gases present in atmosphere? (Rwp 07)

Ans. Importance of gases present in atmosphere

(i) The gases in the atmosphere absorb most of the cosmic rays and the major portion of the harmful electromagnetic radiation coming from the sun.

(ii) The absorption of these harmful radiations protects the life on the earth.

(iii) The gases present in the atmosphere are essential for sustaining life on earth *i.e.*, O_2 is required for breathing, CO_2 is required for plant photosynthesis. N_2 is used by nitrogen fixing bacteria.

(iv) Water vapours are responsible for sustaining various forms of life on the earth.

(v) Atmosphere also maintains the heat balance of the earth.

27. Name the oxides of nitrogen which cause air pollution? (Sgd 10)

Ans. Oxides of nitrogen causing pollution

Following are the oxides of nitrogen which cause pollution

(i) Nitric oxide (NO)

(ii) Nitrogen dioxide (NO_2)

28. Write names of treatments for purification of H_2O in various stages? (Sgd 10)

Ans. Purification of water

Water is purified by the following stages:

(i) Aeration (To remove dissolved gases, organosulphur compounds and VOC)

(ii) Coagulation (To remove suspended particles by using alum)

(iii) Water disinfection (By using Cl_2, ClO_2 or O_3)

29. Discuss livestock waste as water pollutant? (Mtn 08)

Ans. Livestock Waste

Mostly the livestock waste is either being dumped on the open land or is discharged into sewage, canals or rivers. This practice pollutes the surface and ground water posing serious health problems to the population. Chemical and bacterial contents in livestock waste can contaminate surface and ground water causing such infectious diseases as dysentery, typhoid and hepatitis.

30. What is chemical oxygen demand (COD)? (Fsd 09)

Ans. Chemical Oxygen Demand (COD)

"The organic content of water which consume oxygen during chemical oxidation is evaluated by its chemical oxygen demand."

The oxygen demand of water can be determined directly by treating it with dichromate ions $Cr_2O_7^{-2}$ which is a powerful oxidizing agent. The organic matter in water is oxidized while the remaining dichromate is determined by titremetrically. Value of COD is a direct measure of chemically oxidizable matter in water. Higher values of COD will indicate more pollution.

****

bhatti Academy

FEDERAL BOARD

(Academic session (2009-2010) **Section – A (Marks 17)**

CHEMISTRY HSSC-II *Time Allowed: 20 Minutes*

Note: Section-A is compulsory and comprises pages 1- 2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/ overwriting is not allowed. Do not use lead pencil.

1. Circle the correct option i.e, A / B / C / D. Each part carries one mark.

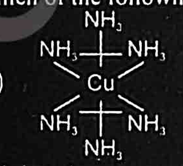
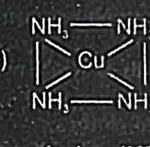
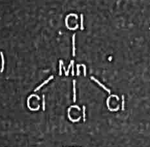
(i) Mark the correct statement from the following about the properties of elements in periodic table.
(A) Melting point of halogens first increases and then decreases down the group.
(B) The ionization energy of calcium is higher than that of beryllium.
(C) Covalent character of metal halides increases from left to right in a periodic table.
(D) Lu is bigger in size then Ce.

(ii) Lithium is the first member of group I.A of the periodic table, yt it shows deviation in physical properties from other members of its own family because of _____.
(A) Its smaller size (B) Absence of d orbitals for bonding.
(C) Having one electron in its valence shell (D) Having high charge density

(iii) Which of the following is the end product when boric acid is strongly heated?
(A) B_2O_3 (B) $H_2B_4O_7$ (C) H_3BO_3 (D) HBO_2

(iv) Sulphur forms three different compounds with chlorine. The type of hybridization shown by sulphur is SCl_6 is _____.
(A) sp^3 (B) dsp^3 (C) sp^2 (D) d^2sp^3

(v) Halogen acids act as reducing agents. Choose form the following the CORRECT order of reducing power of these acids.
(A) HF > DCl < HBr < HI (B) HF < HCl < HBr < HI
(C) HF > HCl > HBr > HI (D) HF < HCl < HBr > HI

(vi) Which of the following compounds forms trigonal bipyramidal shape?
(A) 
(B) 
(C) 
(D) 

(vii) In isomerism, compounds have same molecular formula, but different structure. The possible isomers formed by pentane are _____.
(A) Five (B) Four (C) Three (D) Two

(viii) Choose from the following the catalyst which is used for the partial hydrogenation of alkynes to form trans alkenes.
(A) $\frac{Pb\ Hg(SO_4)}{Quinoline}$ (B) $\frac{Pd\ (Hg\ SO_4)}{Quinoline}$ (C) $\frac{Pd\ (Ba\ SO_4)}{Quinoline}$ (D) $\frac{Nat\ liquid\ NH_3}{-33°C}$

(ix) Which of the following compounds will be sulphonated most readily?
(A) Toluene (B) Benzene (C) Aniline (D) Chlorobenzene

(x) The rate of SN_1 mechanism depends upon _____.
(A) The concentration of uncleophile (B) the concentration of substrate
(C) The concentration of substrate and nucleophile (D) The concentration of catalyst.

(xi) Alcohols react with conc. H_2SO_4 and give different products. What is the product as a result of the equation.

$$2C_2H_5 - OH \xrightarrow[140°C]{Conc.\ H_2SO_4} \rightarrow$$

(A) $CH_1 - CH_2$ (B) $CH_3 - CH_3$ (C) $C_2H_5 - O - C_2H_5$ (D) $CH - CH$

(xii) Which of the following reagents will react with both aldehydes and ketones?
(A) Grignards reagent (B) Tollen's reagent (C) Benedict's reagent (D) Fehling's reagent

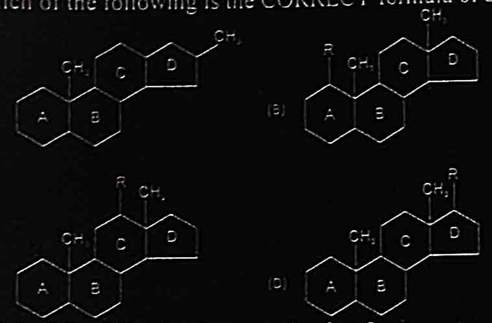
(xiii) Given the general reactin:

$$R - CH_2 - OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} X \xrightarrow{[O]} Y \xrightarrow{[O]} Z$$

	X	Y	Z
(A)	CO_2	Alcohol	Carboxylic acid

(B) Aldehyde Carboxylic acid CO_2
(C) Alchol Aldehyde CO_2
(D) None of these

(xiv) Which of the following is the CORRECY formula of Steroid nucleus?



(xv) which of the following in non-calcarious?
(A) Lime (B) Lime stone (C) Sea shells (D) NH_4OH

(xvi) Which of the following disinfects drinking water?
(A) NH4CI (B) HCI (C) HOCI (D) NH_4OH

(xvii) Which of the following is an electrophile?
(A) H_2O (B) H_2S (C) CI_2 (D) BF_3

Chemistry (Part-II) Lahore Board

Chemistry XII
Time: 20 Minutes

Paper: I
Marks: 17

(Objective)

Q.No.1. Encircle the correct answers.

(i). The decrease in atomic sizes is not much prominent acrossrows containing elements of
(a) s-Block (b) p-Block (c) d-Block (d) f-Block

(ii). One of the following is applied on walls as white wash
(a) lime water (b) milk of lime (c) milk of magnesia (d) lime stone

(iii). Following is used in making fire proof clothes
(a) water glass (b) borax glass (c) kaolin (d) asbestos

(iv). The element whose inorganic minerals are not much abundant in earth crust
(a) Li (b) N (c) Na (d) O

(v). The element which causes burn to skin that heels slowly
(a) F_2 (b) $C\ell_2$ (c) Br_2 (d) acid

(vi). Carbon atom in following is Sp^2-hybridized
(a) CH_3CN (b) $CH \equiv CH$ (c) HCOOH (d) $CH_2C\ell_2$

(vii). Following property of transition elements does not vary with a regular pattern
(a) binding energy (b) melting point (c) covalent radius (d) cationic radius

(viii). The isomerism shown by alkanes is
(a) skeletal (b) position (c) geometric (d) metamerism

(ix). Ortho, para derivatives are obtained by halogenation of
(a) nitrobenzene (b) toluene (c) benzaldehyde (d) benzene

(x). Reaction of following with Grignard's reagent can give p-alcohol
(a) epoxide (b) peroxide (c) super oxide (d) hydrogen oxide

(xi). Methanol can be prepared from hydrogenation of
(a) CH_3CN (b) CH_3Br (c) HCHO (d) CH_3CHO

(xii). Addition of alcohol in carbonyl compounds gives acetal, the geometry of acetal is
(a) linear (b) trigonal (c) tetrahedral (d) planar

(xiii). Molar mass of CH_3C0011 obtained by elevation of boiling point method is
(a) 30 (b) 60 (c) 120 (d) 180

(xiv). Starch is a polymer of
(a) α – D – glucose (b) β – D – glucose (c) α – D – fructose (d) β – D – fructose

(xv). The nitrogenous fertilizer easily taken up by plants is
(a) urea (b) ammonium nitrate (c) ammonia gas (d) ammonia liquid

(xvi). Following is better to disinfect water
(a) $C\ell_2$ (b) O_2 (c) O_3 (d) $KMnO_4$

(xvii). The residual ash after incineration of industrial waste is disposed of in a landfill, which is lined with
(a) portland cement (b) clay and plastic (c) methyl silicone (d) stone-ware

Chemistry-XII Lahore Board

Time: 2:40 Hours

(Subjective)

Marks: 68

(Section-I)

Q.No.2. Write short answers of any 22 of the following questions. (22 x 2 = 44)

(i). Write name and symbol of an element from S-block that has zero oxidation state. Also write its electronic configuration.
(ii). Why melting and boiling points of elements belonging to groups VA-VIIA are lower?
(iii). Solution of Na_20 in water is alkaline. Justify the statement.
(iv). Define metalloid. Give reaction of a metalloid of group III A with oxygen.
(v). Give uses of lead suboxide.
(vi). Show that H_3BO_3 is monobasic acid.
(vii). How $A\ell$ finds its uses in metallurgy and photoflash bulbs?
(viii). Write formulas of chromate and dichromate ions. In which colour they usually exist?
(ix). Name three allotropic forms of phosphorous.
(x). How does aqua-regia dissolves gold?
(xi). The elements of VIIIA group are called noble gases. Commen
(xii). How halogen acids are ionized in water?
(xiii). Define homocyclic compounds. Give example.
(xiv). Give shapes and angles of following compounds using hybridization approach:
(a) $CH_2 = CH_2$ (b) $HC \equiv HC$
(xv). What are fused rings aromatic compounds? Give examples.
(xvi). Predict major product of bromination of nitrobenzene. Also give equation.
(xvii). Mention four uses of ethene.
(xviii). Sigma bonds are inert in alkanes Justify.
(xix). Discuss E2 mechanism.
(xx). Write two uses of each of methanol and ethanol.
(xxi). How will you distinguish between methanol and ethanol?
(xxii). Picric acid is a phenol which behaves like an acid. Justify.
(xxiii). Ethers belong to an inert class of organic compounds. Discuss.
(xxiv). Differentiate between acidic and basic amino acids.
(xxv). (i) Explain one method of formation of formaldehyde frommethyl alcohol. (Diagram not needed)
(xxvi). Give one reaction for formation of an acctal.
(xxvii). Define iodine number.
(xxviii). In what way fats and oils are different?
(xxix). Define enzyme. Name their two properties.
(xxx). Classify elements essential for plant growth.
(xxxi). Enlist steps involved in the manufacturing of urea. viii) Write a note on diammonium phosphate.
(xxxii). What is acid rain? Give one of its harm to building.

(Section-II)

Q.3 (a) Explain periodic trends in the following physical properties:
(i) Atomic radius (ii) Electron affinity
(b) Describe eight points to discuss role of lime in industries. (4)
Q.4 (a) Explain reforming of petroleum with the help of suitable example. (4)
(b) What are S_N reactions? Differentiate between S_N1 and S_N2 reactions. (4)
Q.5 (a) Convert the following:
(i) Propyne into acetone (ii) Ethyne into oxalic acid
(b) Discuss the reaction of cthanal and propanone with: (4)
(i) Hydroxylamine. (ii) Phenyl hydrazine
Q.6 (a) Define Friedel Crafts reactions. Give mechanism with an example of Friedel-Craft's acylation reaction. (4)
(b) Define Zwitter ion. Discuss effect of acidic and basic medium on the dipoler ion structure of amino acid. (4)
Q.7 (a) How steel can be manufactured by Bessemer's process? (4)
(b) Explain the process of incineration of industrial waste. (4)

bhattiAcademy

Chemistry (Part-II) GUJRANWALA Board

Chemistry XII
Time: 20 Minutes

(Objective)

Paper: I
Marks: 17

Q.No.1. Encircle the correct answers.

(i). The strongest acid is
(a) HF (b) HBr (c) HCℓ (d) HI

(ii). Orthoboric acid when heated to red hot gives
(a) boric anhydride (b) pyroboric acid (c) metaboric acid (d) tetraboric acid

(iii). Hybridization of carbon is carbonyl group is
(a) sp^3 (b) sp^2 (c) dsp^2 (d) sp

(iv). Fungicides are the pesticides which
(a) control the growth of fungus (b) kill insects (c) kill plants (d) kill herbs

(v). Which is not calcareous material?
(a) lime (b) clay (c) marble (d) marine shell

(vi). Which compound is polyprotiee acid?
(a) CH_3COOH (b) $C_6H_4(OH)COOH$ (c) $(COOH)_2$ (d) C_6H_5OH

(vii). Which liquid is called wood spirit?
(a) CH_3OH (b) C_2H_5OH (c) CH_3COOH (d) CH_3-O-CH_3

(viii). Molecule of benzene contains
(a) three double bonds (b) two double bonds (c) one double bond (d) delocalized π – electron charge

(ix). How many isomers are there in pentane?
(a) 6 (b) 5 (c) 3 (d) 2

(x). The highest ionization energy is possessed by
(a) nitrogen (b) phosphorous (c) bismuth (d) antimony

(xi). S_N1 reactions are easily given by
(a) primary alkyl halide (b) secondary alkyl halide (c) secondary alcohols (d) primary alcohols

(xii). Lindlar's catalyst is
(a) $Ba|PbSO_4|$ Quinoline (b) $Pd|PbSO_4|$ Quinone (c) $Pd|BaSO_4|$ Quinoline (d) $Pd|BeSO_4|$ Quinone

(xiii). Newspapers can be recycled again and again for how many times?
(a) 2 (b) 3 (c) 4 (d) 5

(xiv). Which polymer is addition polymer?
(a) nylon 6.6 (b) polystyrene (c) terylone (d) expoxy resin

(xv). Indicate amphoteric oxide
(a) MgO (b) BeO (c) SrO (d) CaO

(xvi). f-block elements are also called
(a) non-typical transition elements (b) outer transition elements
(c) inner transition elements (d) normal transition elements

(xvii). The number of elements in fourth period of periodic table is
(a) 32 (b) 18 (c) 10 (d) 8

Inter (Part-II) Lahore Board 2013

CHEMISTRY
PARER-I (Objective Type)

GROUP-I

Time : 20 Minutes
Marks : 17

Note: Four possible answers A. B. C and D to each question are given. The choice which you think is correct, fill that circle, in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

1.1. Synthetic rubber is made by polymerization of:
(A) Chloroform (B) Acetylene (C) Divinyl acetylene (D) Chloroprene

2. In the purification of potable water the coagulant used is:
(A) Nickel sulphate (B) Copper sulphate (C) Barium sulphate (D) Alum

3. Which of the following will have highest boiling point:
(A) Methanol (B) Ethanal (C) Propanal (D) 2-Hexanone

4. Which of following sulphates is not soluble in water:
(A) Sodium sulphate (B) Potassium sulphate (C) Zinc sulphate (D) Barium sulphate

5. Which set of hybrid orbitals has planar triangular shape:
(A) sp^3 (B) sp (C) sp^2 (D) dsp^2

6. For which mechanism, the first step involved is the same:
(A) El and E2 (B) E2 and SN^2 (C) Wand E2 (D) El and SN^2

7. Which element among the following belongs to Group IV A of the periodic table:
(A) Barium (B) Iodine (C) Lead (D) Oxygen

8. Which woody raw material is used for the manufacture of paper pulp:
(A) Cotton (B) Bagasse (C) Popular (D) Rice straw

9. Which one of the following enzymes brings about the hydrolysis of fats:
(A) Urease (B) Maltase (C) Zymase (D) Lipase

10. When sugar is treated with Conc. H_2SO_4 it becomes black due to:
(A) Decolourization (B) Dehydration (C) Hydrolysis (D) Hydration

11. Acetamide is prepared by:
(A) Heating ammonium acetate (B) Heating methyl cyamide
(C) Heating ethyl acetate (D) The hydrolysis of methyl cyanide

12. The anhydride of $HC\ell O_4$ is:
(A) $C\ell_2O_3$ (B) $C\ell O_2$ (C) $C\ell_2O_5$ (D) $C\ell_2O_7$

13. Which compound will have the maximum repulsion with water:
(A) C_6H_6 (B) C_2H_5OH (C) $CH_3\text{-}CH_2\text{-}CH_2\text{-}OH_2$ (D) $CH_3\text{-}O\text{-}CH_3$

14. Which one is true about melting points of halogens:
(A) Decrease down the group (B) Increase down the group
(C) Remain same in group (D) First increase then decrease down the group

15. Amongst the following, the compound that can be most readily sulphonated is:
(A) Toluene (B) Benzene (C) Nitrobenzene (D) Chlorobenzene

16. Which is most difficult to oxidize:
(A) C_2H_5CHO (B) CH_3CHO (C) HCHO (D) CH_3COCH_3

17. Which compound is prepared by Stadeler's process
(A) $K_2Cr_2O_7$ (B) $KMnO_4$ (C) K_2CrO_4 (D) K_2MnO_4

CHEMISTRY
PARER-I (Essay Type)

GROUP-I

Time Allowed: 3.10 Hours
Maximum Marks: 83

(SECTION-I)

2. Write short answers to any EIGHT (8) questions: 16
(i) Why diamond is a non-conductor and graphite is fairly a good conductor?
(ii) Define electron affinity. Discuss its trend in periodic table.
(iii) Why lime water turns milky by passing CO_2 gas?
(iv) KO_2 is used by mountaineers. Discuss.
(v) What is plaster of paris?

bhattiAcademy

(vi) Give two methods for preparation of PCl_3
(vii) Write two reactions in which H_2SO_4 acts as dehydrating agent.
(viii) Write two points of dissimilarities of oxygen and sulphur.
(ix) Write four uses of halogens.
(x) Explain chromyl chloride test.
(xi) Convert methane into:
(i) Formaldehyde (ii) Nitromethane.
(xii) Prepare ethene from
(i) Ethyl alcohol (ii) Ethylchloride

3. Write short answers to any EIGHT (8) questions: 16
(i) Write down formulas for Bauxite and Corundum.
(ii) What is Chemistry of Borax-bead Test?
(ii) Define Tautomerism and give / example.
(iv) What are Alicyclic and Aromatic Compounds? Give one example in each.
(v) Briefly describe X-rays studies of benzene structure.
(vi) Define resonance and write down resonance structures of benzene.
(vii) Write down reactions of ethanol with
(i) PBr_3 (ii) PCl_5
(viii) Define nucleophile and electrophile. Give one example in each.
(ix) What are primary and secondary alcohols? Give one example in each.
(x) How methanol is prepared from water gas? (xi) Write down formulas of malonic acid and oxalic acid.
(xii) How carboxylic acid are prepared by the oxidative cleavage of alkenes.

4. Write short answers to any SIX (6) questions: 12
(i) How aldehyde reacts with phenyl hydrazine, give its mechanism?
(ii) What is Tollen Test? Illustrate your answer with chemical equation.
(iii) Explain oxidation of aldehyde.
(iv) How acetaldehyde distinguish from formaldehyde?
(v) Define polymerization, explain the term degree of polymerization.
(vi) Define acid number. What is rancidity?
(vii) What are essential nutrients element and why these are needed?
(viii) How ammonium nitrate is prepared. Describe the process.
(ix) Write to structure of starch.

(SECTION-II)

Note: Attempt any THREE questions.

5. (a) Explain variation of
(i) Ionization potential (ii) Electrical conduction along period and groups
(b) Show four reactions in which lithium behaves different from elements of its own group. 4

6. (a) Write a note on classification of organic compounds.
(b) Prepare the following compounds from carboxyl compounds:
(i) Lactic acid (ii) Paraldehyde
(iii) Ethanal oxime (iv) Croton aldehyde 4

7. (a) How can you convert: 4
(i) 2.3 - Dibromo butane into 2-Butene
(ii) Acetone into propane
(ii) Acetylene into vinyl acetylene.
(iv) Acetylene into disilver acetylide
(b) Describe briefly the two possible mechanisms of β-elimination reactions. 4

8. (a) Write a note on Friedel-Craft's reaction. 4
(b) How would you prepare carboxylic acid by hydrolysis of esters and from alkyl nitriles? 4

9. (a) How does the electronic configuration of valance shell affect the following properties of the transition elements: 4
(i) Para magnetism (ii) Oxidation states
(b) Discuss the term' acid rain' along with its effects on environment. 4

Inter (Part-II) Lahore Board 2013
Group II

CHEMISTRY **(Group II)** **Time : 20 Minutes**
PARER-I (Objective Type) **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that circle in front of that question number with marker or pen on the Answer Book provided. Cutting or filling two or more circles will result in zero mark in that question. Attempt as many questions as given in objective type question paper and leave others blank.

1.1. Keeping in view the size of atoms, which order is the correct one?
(A) Mg > Sr (B) 3a > Mg (C) Lu > Ce (D) $C\ell > I$

2. Which is not an alkali metal?
(A) francium (B) casein (C) rubidium (D) radium

3. Which metal is used in the thermite process because of its activity?
(A) iron (B) copper (C) aluminium (D) zinc

4. Laughing gas in chemically
(A) NO (B) N_2O_2 (C) NO_2 (D) N_2O_4

5. Which hydrogen halide is the weakest acid in solution?
(A) HF (B) HBr (C) HI (D) HCl

6. The strength of binding energy of transition elements depends upon
(A) number of electron pairs (B) number of unpaired electrons
(C) number of neutrons (D) number of protons

7. The state of hybridization of carbon atom in methane is
(A) sp^3 (B) sp^2 (C) sp (D) dsp^2

8. β-β dibhloroethyl sulphide is commonly known
(A) mustard gas (B) laughing gas (C) phosgene gas (D)

9. Benzene cannot undergo
(A) substitution reactions (B) addition reactions
(C) oxidation reactions (D) eliminationreactions

10. When CO_2 is made to react with ethlyl magnesium iodide, followed by acid hydrolysis, the product formed is
(A) propane (B) propanoic acid (C) propanal (D) propanol

11. Which compound shows hydrogen bonding?
(A) C_2H_6 (B) C_2H_5Cl (C) CH_3-O-CH_3 (D) C_2H_5OH

12. Cannizzaro's reaction is not given by
(A) formaldehyde (B) acetaldehyde
(C) benzaldehyde (D) trimethyl acetaldehyde

13. Which reagent will react with both aldehydes and ketones?
(A) Grignard's reagent (B) Tolien's reagent
(C) Fehling's reagent (D) Benedict's reagent

14. Which derivative cannot he prepared directly from acetic acid.
(A) acetamide (B) acetyl chloride
(C) acetyl anhydride (D) ethyl acetate

15. Which enzyme brings about the hydrolysis of fats?
(A) urease (B) maltase (C) zymase (D) lipase

16. Which woody raw material is used for the manufacture of paper pulp?
(A) cotton (B) bagasse (C) poplar (D) rice straw

17. The main pollutant of leather tanneries in the waste water is due to the salt of
(A) lead (B) chromium (C) copper (D) chromium(III)

CHEMISTRY **(Group II)** **Time Allowed: 3.10 Hours**
PARER-I (Essay Type) **Maximum Marks: 83**

(SECTION-I)

2. Write short answers to any EIGHT (8) questions: 16
(i) Why is the oxidation state of noble gases usually zero?
(ii) How does ZnO behave as an amphoteric oxide?
(iii) Why is two percent gypsum added to cement?

phattiAcademy

(iv) Why lime water becomes milky when CO_2 is passed through it?
(v) What is milk of magnesia and for which treatment is it used?
(vi) How is Aqua Regia prepared? What is its use? (vii) Write reactions of two metals which evolve hydrogen upon reaction with HNO3.
(viii) Give four dissimmilarities of oxygen and sulphur.
(ix) Why HF is weaker acid than HCl?
(x) How does K_2CrO_7 act as an oxidizing agent in the presence of H_2SO_4?
(xi) Prepare disilver acetylide by using acetylene.
(xii) Write the reaction of dehydrohalogenation of ethyl bromide to prepare ethene.

3. Write short answers to any EIGHT (8) questions: 16
(i) Why is CO_2 a gas at room temperature while SiO_2 is a solid?
(ii) How will you convert boric acid into borax and vice versa?
(iii) Differentiate between homocycle and heterocyclic compounds with one example for each.
(iv) Define hydrogenation. Give its two applications.
(v) How benzene can he converted into meta ehloronitrobeirizene?
(vi) What is Wurtz-Fitting Reaction? Give an example.
(vii) How Grignard reagents react with epoxides to form alcohol?
(viii) Why tertiary alkyl halides follow SNI mechanism and not SN_2 mechanism?
(ix) What is bakelite? How is it prepared form phenol?
(x) How ethanol gives different products with conc. H_2SO_4 under different conditions?
(xi) How acetic acid can be converted into acetome?
(xii) What are twitter ions? How these react with acids and bases?

4. Write short answers to any SIX (6) questions: 12
(i) Give four uses of formaldehyde.
(ii) How are aldehydes identified by Tolien's test?
(iii) Convert formaldehyde to meta formaldehyde.
(iv) Convert calcium acetate to acetone.
(v) Explain saponification with an example.
(vi) What is meant by denaturation of proteins?
(vii) What are macronutrients? Give their names.
(viii) What are clinkers?
(ix) Write down formulas for
(a) superphosphate (b) triple phosphate.

5. (a) Write a brief note on halides. 4
(b) What is Nelson Cell? Draw its diagram and show 4

6. (a) Define functional group Name typical functional groups containing oxygen.
(b) How does formaldehyde react with the following reagents?
(i) HCN (ii) $NaliSO_3$ (iii) $NaBH_4/H_2O$ (iv) conc. NaOH

7. (a) Starting from ethene, outline the reactions for preparation of the following compounds:
(i) 1.2 dibromoethane (ii) ethyne (iii) ethane (iv) ethylene glycol
(b) Write a note on SN_2 reaction. 4

8. (a) Explain the structure of benzene in the atomic orbital treatment.
(b) Write down the mechanism of reaction acetic acid and thionyl chloride.

9. (a) Explain the following terms y giving examples: 4
(i) Ligands(ii) Co-ordination sphere
(b) What is smog? Give conditions for the formation of a smog. 4

Inter (Part-I) Gujranwala Board 2013

CHEMISTRY
PARER-II (Objective Type)
Time : 20 Minutes
Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that circle in front of that question number with marker or pen on the Answer Book provided. Cutting or filling two or more circles will result in zero mark in that question. Attempt as many questions as given in objective type question paper and leave others blank.

1.1. Benzene cannot undergo
(A) substitution reactions (B) addition reactions
(C) oxidation reactions (D) elimination reactions

2. Which compound shows hydrogen bonding?
(A) C_2H_6 (B) C_2H_5Cl (C) C_2HO_3H (D) C_2H_5OH

3. The strength of binding energy of transition elements depends upon
(A) number of electron pairs (B) number of unpaired electrons
(C) number of neutrons (D) number of protons

4. The main pollutant of leather tanneries in the waste water is due to the salt of
(A) lead (B) chromium (C) copper (D) chromium (III)

5. Which enzyme brings about the hydrolysis of fats?
(A) urease (B) maltase (C) zymase (D) lipse

6. Which reagent will react with both aldehydes and ketones?
(A) Grignard's reagent (B) Tolien's reagent
(C) Fehling's reagent (D) Benedict's reagent

7. When CO_2 is made to react with ethyl magnesium iodide, followed by acid hydrolysis, the product formed is
(A) propane (B) propanoic acid (C) propanal (D) propanol

8. The state of hybridization of carbon atom in methane is
(A) sp^1 (B) sp^2 (C) sp (D) dsp^2

9. Which hydrogen halide is the weakest acid in solution?
(A) HF (B) HBr (C) HI (D) HCl

10. Which metal is used in the thermite procees of its activity?
(A) Iron (B) Copper (C) aluminium (D) zinc

11. Keeping in view the correct one?
(A) Mg > Sr (B) Ba > Mg (C) Lu > Ce (D) Cl > I

12. Which woody raw material is used for the manufacture of paper pulp?
(A) cotton (B) bagasse (C) poplar (D) rice straw

13. Which derivative cannot be prepared directly acetic acid?
(A) acetamide (B) Acetyl chloride
(C) acetic anhydride (C) Ethl acetates

14. Which is not an alkali metal?
(A) francium (B) caesiuni (C) rubidium (D) radium

15. β-β dichloroethyl sulphide is commonly known as:
(A) mustard gas (B) laughing gas (C) phosgene gas (D) bio-gas

16. Cannizzaro's reaction is not given by
(A) formaldehyde (B) acetaldehyde
(C) henzaldehyde (D) trimethyl acetaldehyde

17. Laughing gas is chemically
(A) NO (B) N_2O (C) NO_2 (D) N_2O_2

CHEMISTRY
PARER-II (Essay Type)
Time Allowed: 3.10 Hours
Maximum Marks: 68

(SECTION-I)

2. Write short answers to any EIGHT (8) questions: 16
(i) Why is the oxidation state of noble gases usually zero?
(ii) How does ZnO behave as an amphoteric oxide?
(iii) Why is two percent gypsum added to cement?
(iv) Why lim water becomes milky when CO_2 is passed through it?
(v) What is milk of magnesia and for which treatment is it used?
(vi) How is aqua Regia prepared? What is its use?
(vii) Write reactions of two metals which evolve hydrogen upon reaction with HNO_3.
(viii) Give four dissimrnilarities of oxygen and sulphur.
(ix) Why HF is weaker acid than HCl?
(x) How does $K_2Cr_2O_7$ act as an oxidizing agent in the presence of H_2SO_4?
(xi) Prepare disilver acetylide by using acetylene.
(xii) Write the reaction of dehydrohalogenation of ethyl bromide to prepare ethene.

3. Write short answers to any EIGHT (8) questions: 16
(i) Why is CO_2 a gas at room temperature while SiO_2 is a solid?
(ii) How will you convert boric acichinto borax and vice versa?
(iii) Differentiate between homocyclic and heterocyclic compounds with one example for each.
(iv) Define hydrogenation. Give its to application.

Punjab Academy

(v) How benzene can be converted into meta chloront-lbenzene?
(vi) What is Wurtz-Fitting Reaction? Give an example.
(vii) How Grignard reagents react with epoxides to form alcohol?
(viii) Why tertiary alkyl halides follow SN1 mechanism and not SN2 mechanism?
(ix) What is bakelite? How is it prepared from phenol?
(x) How ethanol gives different products with conc. H_2SO_4 under different conditions?
(xi) How acetic acid can be converted into acetone?
(xii) What are zwitter ions? How these react with acids and bases?

4. Write short answers to any SIX (6) questions: 12
(i) Give four uses of formaldehyde.
(ii) How are aldehydes identified by Tollen's test?
(iii) Convert formaldehyde to meta formaldehyde.
(iv) Convert calcium acetate to acetone.
(v) Explain saponification with an example.
(vi) What is meant by denaturation of proteins?
(vii) What are macronutrients? Give their names. (viii)What are clinkers?
(ix) Write down formulas for
(a) super phosphate (b) triple phosphate

(SECTION-II)

5. (a) Write a brief note on halides. 4
(b) What is Nelson Cell? Draw its diagram and show its working. 4
6. (a) Define functional group. Name typical functional groups containing oxygen.
(b) How does formaldehyde react with the following reagents?
(i) HCN (ii) $NaHSO_3$
(iii) $NaBH_4/H_2O$ (iv) cone. NaOH
7. (a) Starting from ethene, outline the reactions for preparation of the following compounds. 4
(i) 1,2 dibromoethane (ii) ethyne (iii) ethane (iv) ethylene glycol
(b) Write a note on SN_2 reaction. 4
8. (a) Explain the structure of benzene in the light of atomic orbital treatment. 4
(b) Write down the mechanism of reaction between acetic acid and thionyl chloride. 4
9. (a) Explain the following terms by giving examples: 4
(i) Ligands(ii) Co-ordination sphere
(b) What is smog? Give conditions for the formation of a smog. 4

BOARD MODEL PAPER 2014

CHEMISTRY PART – II

Note:- You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

Q.1	Questions	(A)	(B)	(C)	(D)
1.	ZnO is	Basic	Acidic	Amphoteric	Neutral
2.	Na2CO3 is called	Washing soda	Baking soda	Caustic soda	Soda lime
3.	If temperature is dropped from 100 ^oC to 10^oC, the viscosity of petroleum oil may increase to	70 fold	80 fold	90 fold	100 fold
4.	N_2O is called	Tear gas	Laughing gas	Mustard gas	Phosgene gas
5.	The only halogen atom which can directly combine with noble gas is	F	Cl	Br	I
6.	Which of this is non typical transition element?	Cr	Mn	Zn	Fe
7.	Tuatomerism arises due to shifting of	Pi electrons	Sigma electrons	Proton	Neutron

8.	Synthetic rubber is formed by the polymerization of	Chloroform	Acetylene	Di vinyl acetylene	Chloroprene
9.	Preparation of vegetable ghee involves	Hydrogenation	Dehydrogenation	Halogenation	Hydroxylation
10.	Benzene cannot undergoes reaction	Substitution	Addition	Oxidation	Elimination
11.	Which of this is not a nucleophile	H_2O	H_2S	BF_3	NH_3
12.	Rectified spirit contains alcohol about	80%	85%	90%	95%
13.	Which of this compound is used in processing of anti polio vaccine?	Formaldehyde	Acetaldehyde	Benzaldehyde	Salicydehyde
14.	Which of this is not faty acid?	Propanoic acid	Acetic acid	Phthalic acid	Butanoic acid
15.	Which of this element is not present in all amino acids?	Hydrogen	Carbon	Nitrogen	Sulphar
16.	Phosphorus helps the growth of	Root	Leaves	Stem	Seeds
17.	Newspaper can be recycled again and again by how many times	2	3	4	5

Model Paper Chemistry Subjective

Intermediate Part – II (12th Class) Examination Session 2012-2014 and onward

Total marks: 83 **Time: 3:10 hours**

SECTION --- I

2. Write answers of any EIGHT questions. **(8 x 2 = 16)**
(i) Alkali compounds give ionic compounds, give reason
(ii) Give the trend of metallic character in periodic table
(iii) Give advantage of Down cell method
(iv) Lime is added in an acidic soil, give reason
(v) What is chemical garden?
(vi) CO_2 is gas at room temperature and SiO_2 is solid, give reason
(vii) Liquid Silicones are generally preferred over ordinary organic liquids give reason
(viii) What happened when Boric acid is strongly heated?
(ix) NO_2 is an oxidizing agent, prove
(x) Nitrous acid can behave as reducing agent, prove
(xi) Give two reason of Sulphuric acid asdehydrating agent
(xii) Describe Ring test

3. Write answers of any EIGHT questions. **(8 x 2 = 16)**
(i) What is Iodized salt?
(ii) What are Feron and Teflon?
(iii) HF is weaker acid than HCl, give reason
(iv) Damaged tin get rusted quickly. Give reason
(v) Give importance of refining of Petroleum
(vi) Give catalytic oxidation f Methane
(vii) Write the structure of Phenanthrene
(viii) Convert Benzene to p – chloro nitro benzene
(ix) SN2 reactions are second order reactions, Justify
(x) Prepare ethanol from molasses
(xi) Write Lucas test
(xii) Aqua Regia can dissolve gold and Platinum, Give reason

4. Write answers of any SIX questions. **(6 x 2 = 12)**
(i) How will you distinguish between ethanol and methanol?
(ii) Write two uses of acetaldehyde
(iii) What is iodine number?

bhattiacademy

(iv) What is denaturation of protein
(v) Write down the woody raw materials of paper industry
(vi) Fertilizers are needed for better production of corps. Justify.
(vii) Wet method of preparation of cement is preferred over dry method in Pakistan, give reason
(viii) Write silver mirror test
(ix) Detergents are serious threat to aquatic life, Justify?

SECTION II (Essay Type)

Note:- Attempt any three questions. (8 x 3 = 24)

5.
(a) Justify the position of Hydrogen in periodic chart?
(b) Compare the Chemical behavior of Li with Mg.

6.
(a) Describe briefly manufacturing of Wrought iron from Cast iron.
(b) What is cracking discuss its various types.

7.
(a) Describe the acidic nature of alkynes
(b) Describe Nitration of benzene with mechanism

8.
(a) Discuss E1 reactions
(b) Write mechanism of aldol condensation

9.
(a) What are amino acids discuss their different types briefly
(b) What are effects of polluted air on environment.

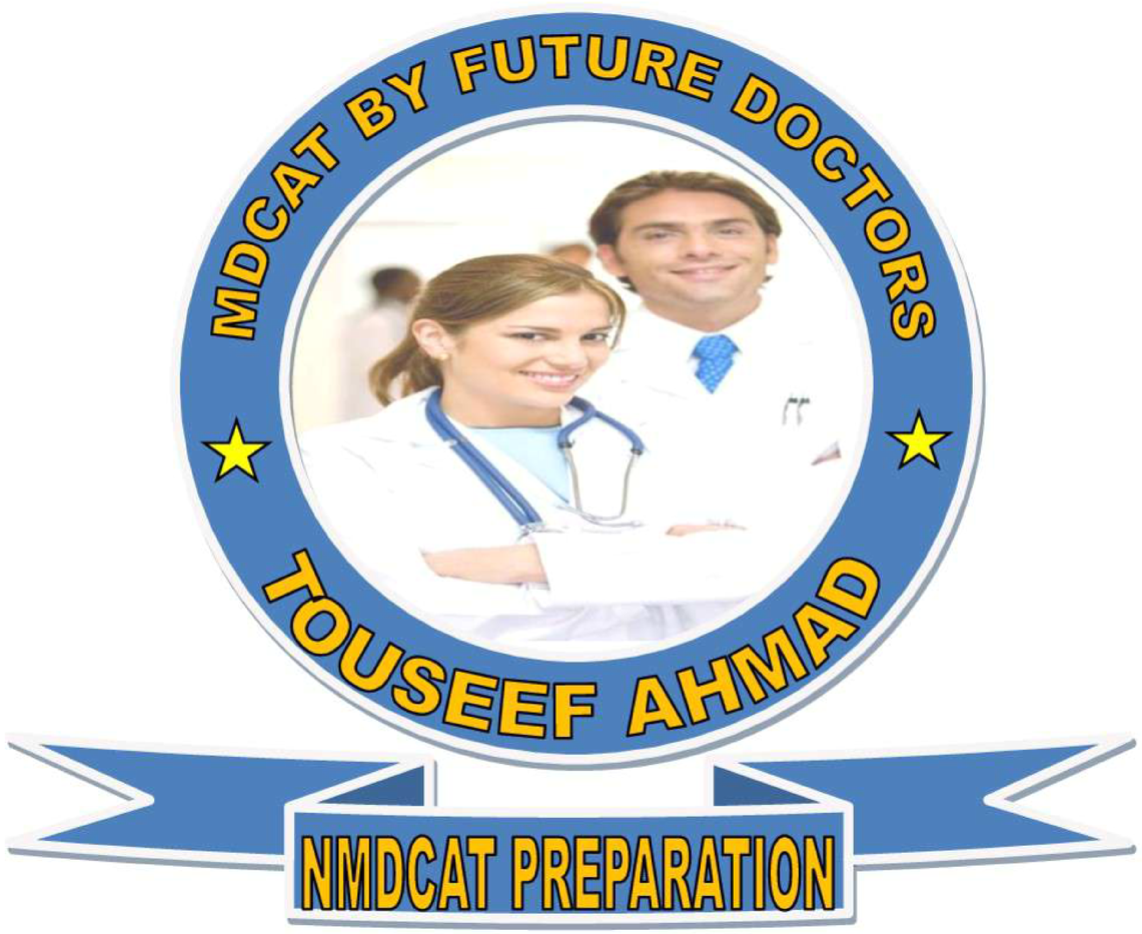
SECTION III (Practical)

10.
(a) **Give answers to any Four Questions.** 4 x 2 = 8

(i) (a) What are the Limitations of Flame test?
(b) Write the chemistry of Chromyl Chloride?
(ii) (c) Give the application of common ion effect in salt analysis
(d) Write down two confirmatory tests for the detection of sodium
(iii) (a) Write the chemistry of Borax bead test.
(b) Write down two confirmatory tests to detect Sulphite
(iv) Write the method for the preparation of glucosazone
(v) How will you detect Nitrogen and various halogens in organic compound?

****

bhatti Academy


MDCAT BY FUTURE DOCTORS
TOUSEEF AHMAD
NMDCAT PREPARATION